A SHORT PRACTICE OF OPHTHALMOLOGY

(ANCIENT AND MODERN)

BY

DR. K. KRISHNAMURTY

AND

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PREFACE

This book differs from the rest of its kind in that it aims to help the medical students and practitioners to have a comparative idea of Modern and Ancient Ophthalmology.

Few of us are aware that the world's first Ophthalmic Surgeon was Susruta of India's antiquity, and some of his teachings on the principles and practice of Ophthalmology can very well stand the rigid test of Modern Science. The section on Ancient Ophthalmology embodies the result of investigations by one of us (Bidyadhar), made possible by the generosity of the enlightened ruler of Sonpur State, Sri S. S. Singh Deo.

The section on Modern Ophthalmology represents the crystallised views and experience of a number of prominent practising Ophthalmic Surgeons of our country to whose collaboration the authors are indeed grateful.

Although this publication is not intended to be dealt with in the manner of a text-book, and therefore suffers from inevitable defects of classification and description, yet every effort has been made to make it a compendium of useful information for reference by and the guidance of the junior Ophthalmic Surgeons and the general practitioners.

We have reproduced, with a due sense of modesty, a few outstanding publications from modern ophthalmic literature in its various aspects, Indian and Foreign. We are really grateful for the courtesy and permission given to us for such reproductions by the editors of *Archives of Ophthalmology* (New York), *Indian Journal of Ophthalmology* (Poona), *Medical Digest* (Bombay), *Antiseptic* and the *Indian Medical Journal* (Madras).

We have also drawn freely from the proceedings of the All-India Ophthalmological Society, and also from the standard Ophthalmological publications. Our indebtedness is in no small measure due to them also.

If this work successfully meets the average need of the ophthalmic side of the general practitioner as well as of the ophthalmic practitioner himself, we will be content.

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A SHORT PRACTICE OF OPHTHALMOLOGY

(ANCIENT AND MODERN)

ANATOMY AND PHYSIOLOGY OF THE EYE

The eyeball or the globe lies in the orbital cavity which is like a four-sided pyramid with the base in front. There are 2 walls, nasal and temporal, formed by the orbital bones. The orbit is traversed posteriorly by three openings:—(1) The Optic foramen, traversed by the optic nerve, ophthalmic artery and vein, (2) the Superior orbital fissure, traversed by the nerves supplying the muscles of the eye and 1st branch of Trigeminus; and (3) the inferior orbital fissure, traversed by the branches of the Trigeminus. The orbit is lined internally by a fascia known as orbital fascia. The fascia that surrounds the bulb is very thick and is known as Fascia bulbi or otherwise known as Tenon's capsule. It goes in front under the conjunctival sac while it extends backwards to the neighbourhood of the optic nerve.

The orbit serves to protect the eyeball safely from all external injuries.

The walls of the globe are composed of dense elastic membranes with the cornea in front and the sclera on all sides. The sclera is covered in front by the conjunctiva.

The Cornea:—It is nearly circular. It consists of five layers from without inwards, viz., (1) The layer of epithelial cells; (2) The Bowman's membrane; (3) The proper substance of the cornea; (4) The Descemet's membrane; and (5) The layer of endothelium. There is no blood vessel in the cornea. Its nutrition is provided by lymph vessels travelling in the substance of the cornea. It is richly supplied by the anterior ciliary nerves. The cornea serves to refract rays of light to fall upon the retina.

The Conjunctiva:—It is a thin layer of mucus membrane and lines the eyelids behind and the sclera in front. It is divided into three parts: the palpebral, the bulbar and the transition portions. The bulbar portion covers the anterior surface of the eyeball. It is loosely connected

to the sclera except at the limbus (Corneo-scleral junction), the transitional fold being loose lies between the palpebral and the bulbar conjunctiva. It ensures greater freedom to the eyeball. It is richly supplied by blood vessels derived from the posterior conjunctival and anterior conjunctival vessels. The ducts of the lacrymal and the numerous mucous glands open into the conjunctival sac.

The Sclera:—It is an opaque comparatively inelastic fibrous layer and along with the cornea it serves as the external fibrous layer of the eyeball. It is pierced posteriorly by the optic nerve and blends with the sheath of the nerve. The extrinsic muscles of the eyeball are inserted into it in front. Its inner surface is brown and rough and is separated from the choroid by lymph spaces. Though it is traversed by very many blood vessels, its blood supply is very poor. The episcleral tissue is richly supplied by blood vessels.

The Anterior Chamber:– It is a narrow cavity bounded in front by the cornea and behind by the iris and the lens. It is about 2.8 m.m. deep in the middle in a normal person. Normally the anterior chamber is bounded on either side by a small portion of the sclera, which is known as the angle of the anterior chamber. At this area in the inner layers of the sclera, there is a net work of venous spaces. This is called the canal of schlemm.

The Iris:—It is a circular coloured membrane hanging behind the cornea and in front of the lens. It is perforated in the centre by a round aperture known as the pupil. It is attached peripherally to the ciliary body while its medial border forms the boundary of the pupil. The inner border of it lies ordinarily on the anterior capsule of the lens but hangs freely in the maximum dilatation of the pupil.

The sphincter pupillæ is a narrow band of muscular tissue about 1 m.m. wide situated close to and encircling the pupil. It is supplied by the 3rd nerve. The dilator pupillæ constituting of the unstriped muscle fibres is supplied by the sympathetic. The blood supply is derived from long posterior ciliary arteries.

The Ciliary Body:—It extends backwards from the root of the iris to the anterior part of the choroid. It consists of the ciliary processes and the ciliary muscle. The ciliary muscle consists of nonstriated muscle fibres. It is the muscle of accommodation. When the ciliary muscle contracts, it drags the ciliary processes and the choroid forwards and inwards, thus relaxing the suspensory ligament

and allowing the lens to become more convex. The ciliary processes consist of about 70 folds. They have the same structure as that of the choroid. They secrete nutrient fluid for the cornea, the lens and a part of the vitreous.

The Choroid:—It lines the posterior segment of the eye from the Ora serrata to the scleral foramen. Its inner surface is smooth and brown. It is firmly attached to the sclera at certain places. It consists mainly of blood vessels united by delicate connective tissue.

The choroid functions chiefly as a nutrient organ of the retina, the vitreous, and the lens.

The Retina:—It is a thin transparent membrane, purple in colour. It lies with the choroid behind it and in front it is separated from the vitreous by the hyaloid membrane. It extends forwards to the ciliary body, where it terminates and is called the ora serrata. From there it extends as a thin layer devoid of nerve fibres into the ciliary body and to the posterior surface of the iris. It is loosely attached to the choroid except at the ora-serrata and at the entrance of the optic nerve. The inner surface of the retina presents in the axis of the eyeball a yellow spot the macula lutea 1 to 2 m.m. in diameter and its centre is a depression known as the fovea centralis. This is the region of the most distinct vision. About 3 m.m. to the inner side of the posterior pole of the eye, there is a pale spot known as the optic disc. The disc is slightly raised from the surface of the retina but in the middle it shows a depression known as the physiological cup. Here the blood vessels of the retina enter the eye.

The retina is supplied by the central artery of the retina. The central vein accompanies the artery and drains into the ophthalmic veins.

The retina is composed mainly of two parts, the nervous elements and the supporting tissue. The rods and cones form the light perceiving layer of the nervous elements. They are the terminal organs of the optic nerve. In the fovea, cones only are present. The disc is completely devoid of retinal layers and so insensitive to light and is called the blind spot. The rods and cones receive the waves of light which fall upon the retina and convert these vibrations into impulses, which are carried by the optic nerves and tracts to the brain. When the image of an object falls upon the macula it gives a distinct vision (Acute Vision), but if it falls on any other part of the retina it gives an indistinct vision (Blurred Vision).

The image of an object falling upon the retina is always inverted.

The Optic Nerve:—The optic nerve extends from the retina to the optic chiasm. It enters the eyeball by piercing the sclera and choroid at its posterior pole. The outer layers of the sclera at this point become continuous with the sheath of the nerve.

The Lens :—The lens is a transparent, colourless body and lies in the anterior portion of the eyeball between the iris in front and the vitreous behind. The lens with Zonuie and the iris divides the eye into an anterior and a posterior portion.

It presents a convex anterior and a more convex posterior surface, anterior and posterior poles and a rounded circumference. It is covered by a capsule known as the lens capsule. It is held in position by its suspensory ligaments which connect the lens all round to the globe. The lens substance proper consists of a peripheral cortex portion and a central nucleus portion. The nucleus is harder whereas the cortex is semi solid and softer than the nucleus. As age advances the nucleus increases while the size of the cortex decreases. So much so in old age the lens will be hard and unyielding.

The Suspensory Ligament of the Lens:—It is a thin delicate membrane extending from the ciliary processes to the lens capsule. From the ciliary processes the ligament is divided into three layers. The anterior layer is attached to the anterior capsule, the middle to the equator, and the posterior to the posterior capsule of the lens. Between these layers there is an interval which serves as a communication for the anterior and the posterior divisions of the eye.

The lens derives nutrition from the ciliary body and it is completely devoid of blood vessels.

The function of the lens is to focus rays so as to form a perfect image on the retina. This will be brought about by the process of accommodation of the lens (alteration in the refractive power of the lens). This is produced by a change of shape increasing its anterior curvature. In old age the lens will be sclerosed and will not be able to change its shape for the purpose of accommodation.

The Posterior Chamber:—It is an annular space formed in front by the iris, peripherally by the ciliary processes

and behind by the zonule fibers of the lens. The two chambers are united only by the pupil.

The Vitreous Chamber:—It lies behind the lens consisting of vitreous humour. The vitreous is a transparent colourless jelly-like mass. On its anterior surface lies the lens, on either side of it lies the inner surface of the ciliary body while its posterior surface rests on the retina. The vitreous receives its nourishment from the surrounding structures.

THE NERVE SUPPLY OF THE EYE

The nerves that supply the muscles of the eye both within the eyeball and outside are the 3rd, the 4th, the 5th, the 7th and sympathetic nerves. The 3rd nerve (nervous oculomotoris) supplies Rectus medialis, Rectus superior, Rectus inferior, Inferior oblique, Levator palpbrae superioris, sphincter pupillae and the ciliary muscle.

The 4th nerve (Nervous Trochlearis) supplies the Superior oblique.

The 5th nerve (Nervous Abducens) supplies the Lateral rectus.

The 7th nerve (Facial Nerve) supplies the Orbicularis oculi.

The sympathetic nerves supply the Tarsalis, the Orbitalis (of Muller) and the dilator pupillæ.

The sensory nerves are derived from the 1st and the 2nd branches of the Trigeminus.

The ciliary ganglion, lying on the lateral side of the trunk of the optic nerve, receives its motor fibres from the 3rd nerve and the sensory ones from the Trigeminus. The short ciliary nerves which branch off the ganglion pass into the eye through the posterior segment. The long ciliary nerves directly radiate from the Trigeminus and along with the sympathetic nerves derived from the carotid plexes, enter the eye and supply its sensory and the soft muscles. The rest of the nerves the 4th, the 5th, and the 7th nerves separately supply the eye muscles.

THE BLOOD SUPPLY OF THE EYE

The blood supply of the eye is mainly classified under three groups; (1) The conjunctival system, (2) the ciliary system, and (3) the retinal system. The arteries of all these

systems are derived from ophthalmic artery, a branch of the internal carotid. These systems anastomose very little with the neighbouring arteries. The veins almost closely follow the arteries and empty into the cavernous sinus. The veins unlike the arteries anastomose with the neighbouring veins.

The conjunctival system of blood vessels consists of (1) The posterior conjunctival vessels, (2) the anterior conjunctival vessels (branches of ciliary vessels), and (3) the anterior ciliary vessels.

The ciliary group which supplies the whole uveal tract and the four recti muscles, consists of the short posterior, the long posterior and the anterior ciliary arteries.

The retinal system constituting the central artery emerges at the area of the disc. There it divides into two branches an upper and a lower one. These are end arteries and they do not anastomose with each other or with any other arteries.

ANATOMY AND PHYSIOLOGY OF THE ADENEXA OF THE EYE

(1) *Anatomy and physiology of the lids*:—The lids, derived from the folds of the outer skin, move over the bulb, cover and protect it. The lid consists of very many layers—the skin, the loose connective tissue, the muscular tissue, the tarsus, the fascia and the conjunctiva. In addition to these it presents lashes, numerous glands situated in the tarsus, blood vessels, lymphatics and nerves situated between the various layers. The margin of the lid presents an anterior lip and a posterior lip. To the rounded anterior lip are attached the eye-lashes. In front of the sharp posterior lip, the openings of Meibomian glands and anterior to these, the opening of the sweat glands and glands of Moll are present. The interval between the two surfaces is known as the intermarginal space. The margins of the upper and the lower lids unite externally and internally.

The muscles of the upper lid are, the Levator palpebræ superioris and the Orbicularis oculi. The Levator palpebræ superioris, arising from the orbit is attached to the upper border and the anterior surface of the tarsus and to the middle of the skin of the upper lid. The orbicularis muscle lying between the tarsus and the integument is attached to the latter, but glides loosely over the former. The tarsus is a thin plate of dense fibrous tissue, larger in the upper than in the lower lid. The upper and the lower tarsi are connected

with the lateral walls of the orbit by means of internal and external tarsal ligaments. They are connected to the upper and the lower margins of the orbit by the palpebral fascia. Meibomian glands are present in the substance of the tarsus and are about thirty in number. The thin palpebral conjunctiva which is highly vascular is closely adherent to the tarsus. The lymphatics pass into the pre-auricular, the submaxillary and the parotid lymphatic glands.

The lids protect the eyes from injury, excessive exposure to light and from foreign bodies. The tears and secretion from the various glands are being distributed uniformly by the process of the winking of the lids. This keeps the surface of the eyeball moist and washes away any particles of dust, etc. that might enter the eye.

(2) *Anatomy and Physiology of the Lacrymal Sac: The Lacrymal Gland and the Naso-Lacrymal Duct*:—The lacrymal apparatus consists of the lacrymal gland, the sac, and the nasolacrymal duct.

The lacrymal gland secretes the tears and let them off into the conjunctival sac to moisten the eye. In cases of irritation of the eye or excessive psychical stimulation there will be excessive production of tears. The excess will be evacuated via the puncta, the canaliculi, the sac and through the naso-lacrymal duct into the nose. The lacrymal gland is divided into two portions the upper and the lower. The upper being the larger, is placed in the lacrymal fossa of the orbital plate of the frontal bone while the lower, being the smaller is placed just beneath the outer part of the fornix conjunctiva. The structure of the lacrymal gland is similar to that of the salivary gland. The excretory ducts about 12 in number empty the tears into the external half of the superior fornix conjunctiva.

The puncta are the two small openings seen on each lid about 6 m.m. from the inner canthus. The canaliculi start from the puncta and extend upwards and inwards and downwards and open into the lacrymal sac. The sac situated at the inner side of the internal canthus, lies in the fossa, formed by the lacrymal bone and the nasal process of the superior maxillary bone. Its walls are thin. It is covered in front by the internal fascial ligament and some fibres of the orbicularis muscle.

The naso-lacrymal ducts start from the sac and go downwards, slightly outwards and backwards in a canal formed by the superior maxillary, the lacrymal, and the inferior

turbinate bones and terminate below in the fore-part of the inferior meatus of the nose.

Anatomy of the eye as described by Susruta :—

" The eyeball (Nayana-bud-buda) is two fingers in transverse diameter about breadth of one's own thumb in sagittal diameter, and two fingers and a half-round". The eyeball is almost round in shape and resembles the teat of a cow. The black outline is one-third of the whole eye. The pupil is 1/7 of the black outline. There are five Mandalas (circles), six patalas (layers or coats of the eye.)

The five Mandalas (circles) are as follows : —

1. Pakshma-mandala—the circle of the eyelashes,
2. Vartma-mandala—the region of the eyelids.
3. Sveta-mandala—the white or sclerotic region.
4. Krishna-mandala—the black region, cornea, etc.
5. Dristi-mandala—the pupillary region.

The mandalas are so arranged that each preceding one lies within the next in the list.

The six sandhis (junctions, lines of demarcation) are as described below :—

1st Sandhi joining the eyelashes with the eyelids.

2nd Sandhi joining the eyelids with sclerotic region.

3rd Sandhi joining the sclera with the black outline (cornea).

4th Sandhi joining the black region with dristi-mandala (pupillary region).

5th Sandhi lying in the mesial angle of the eye kaninika).

6th Sandhi lying in the external corner (apanga) of the eye.

The four patalas (layers) are :—

Two in the eyelids (vartma-mandala),

Four patalas in the eye proper,

1st coat supported by the jala (aqueous humour) and light (tejas).

2nd coat supported by muscles (ciliary region).

3rd coat or patala consists of fat (vitreous).

4th coat or patala—retina which is a fifth part of whole known as dristi.

DISEASES OF THE EYE

DISEASES OF THE CONJUNCTIVA

Acute Catarrhal Conjunctivitis:—It is an acute inflammation of the conjunctiva. (Fig No. 1)

The acute conjunctival catarrh is brought on by bacteria in majority of cases. It is prevalent in rainy and cold seasons in India. It is highly infectious and it spreads from one eye to the other by means of direct contact. Various organisms have been proved to be the cause of the acute conjunctivitis. But the subjective and objective symptoms in all these cases are almost the same. The common organisms are—Koch-week's Bacillus, Morax-Axenfeld-Diplo Bacillus, Pneumococcus. Measles may produce an attack of acute catarrhal conjunctivitis.

In lighter cases, the conjunctiva of the lids and that of the fornix will be reddened and slightly swollen. The bulbar conjunctiva is generally not affected in milder cases. In very severe cases there will be marked congestion, chemosis, small conjunctival hæmorrhages and oedema of the lids. The secretion varies according to the severity of the condition. In mild cases it is mucoid in character and it becomes mucopurulent in severe cases. The secretion accumulates at night and by early in the morning both the lids get adherent.

There is photophobia with smarting and burning sensation in the eye. The patient feels as if a foreign body is under his conjunctiva due to the presence of the threads of tenacious mucus in the conjunctival sac. When such threads lie on the cornea, they disturb the vision to some extent and the patient often complains of a blurring of vision. This disappears when those threads are removed by washing.

In uncomplicated cases the inflammation disappears spontaneously in 8 to 14 days. In some neglected cases it may lead to chronic inflammation. The acute catarrh affects both the eyes generally. In severe cases corneal ulcers may appear.

Treatment:—In all severe cases of catarrh, the conjunctiva is touched with silver nitrate solution 2%. The lid is everted and silver nitrate solution is painted lightly over the lids and the excess washed out with normal saline or boric lotion. Painting should be done only once a day

and that too in the morning. The painting can be repeated till all the acute symptoms subside. The eye should never be painted roughly as it causes much injury and further inflammation of the lid. During painting, care should be taken to see that the swab does not touch the cornea. Painting can be safely continued even when there are corneal ulcers.

In recent years organic silver compounds are being extensively used. But they are only next in value to silver nitrate solution. Argyral and protargal 15% will be useful. They can be used in mild cases. These may be instilled twice daily both morning and evening. In cases due to diplobacillus, zinc sulphate drops ½ to 1% are advised once daily. To avoid sticking of the lids a mild salve like boric or vaseline may be applied to the borders of the lids at bed time.

If there is much purulent discharge from the eye frequent irrigation of the conjunctival sac with the warm boric or saline lotion is highly advisable. The lids are separated gently and every part of the conjunctival sac is thoroughly washed out. By washing with these lotions, the flakes and the mucus get detached from the conjunctiva and are washed out.

GONORRHOEAL OPHTHALMIA

It is otherwise known as Acute Blennorrhoea. It is an acute inflammation of the conjunctiva which arises from infection with gonorrhoeal virus. It generally affects adults.

This disease is always acquired. It comes generally through direct contamination. Urethritis often accompanies the eye trouble.

Signs and Symptoms:—The incubation period varies from a few hours to 3 days. It starts acutely with great swelling and redness of the lids. The swelling gradually increases to such an extent that it is difficult to open the lids. There is great chemosis of the bulbar conjunctiva. The secretion is serus and abundant. The eye is tender on touching and the patient complains of pain in and around the eye. Slight fever and the swelling of the preauricular gland are also present. This stage lasts for about two days. Then swelling of the conjunctiva and the lids begins to decrease in size. The discharge which was

serus before, turns to mucopurulent and purulent. This condition lasts for about fifteen days.

Then all the signs and the symptoms gradually diminish and within 2 or 3 weeks the eye may return to the normal condition.

The course of the disease varies. The eye generally returns to the normal condition in moderate infections. A severe form of infection generally gives rise to corneal ulcers.

PROGNOSIS is always grave and depends upon the severity of the infection.

TREATMENT

Prophylatic :—It is as important as the treatment itself. The Doctor, the attendants and the Nurses who are in charge, should be very careful in handling the case. Whenever they touch the patient, they should at once clean their hands perfectly. Protective glasses should be worn by them. If accidently any discharge spurts into the attendant's eye, it should be washed immediately with 1 in 1000 perchloride lotion after touching the lids with silver nitrate solution. If one eye of the patient is already infected, the other eye should be guarded against the infection by the application of the Buller's shield to the eye. The patient should be instructed to lie down on the diseased side so as to avoid infection getting into the healthy eye. The materials which have been used for cleansing the eye must be burnt.

The Treatment Proper.—Repeated cleansing of the eye every two hours with the following solutions will be very useful such as: Pot-permanganate 1 in 500, perchloride 1 in 20,000 or 10,000 or concentrated solution of magsulph. The cleansing of the lids also should be done by sterile cotton dipped in the same lotion. When there is a great oedema and swelling of the lids and when opening the lids by physical means is impossible, temporary canthotomy should be done. To combat the acute inflammation ice compresses should be applied over the lids and leeches may be applied to the temples to relieve the congestion. Ice application is contra-indicated in cases of corneal ulcers.

Milk injections, started with 5 c.c. and increased up to 10 c.c. form a sovereign remedy in all acute conditions. 2 or 3 injections are necessary. If there is no action even after 2 or 3 injections they can be discontinued.

As soon as the tense swelling of the lids and the conjunctiva begin to decrease, treatment with 2% silver nitrate solution should be started and continued as long as the secretion and the hypertrophy of the lid persist.

The presence of a corneal ulcer is no contra-indication to the use of silver nitrate.

Ophthalmia Neonatorum :—Conjunctival inflammation in the new-born within 2 or 3 days is known as the Ophthalmia Neonatorum.

In majority of cases the gonococcus is the causative organism but in very few cases the streptococci and the B. coli form the cause. During the process of delivery the child's head and eyes pass through the genital canal and receive the infection from the mother. The disease appears on the 2nd or the 3rd day after delivery. When the disease appears still later it cannot be ascribed to factors connected with birth. Late infection comes from the genital secretion of the mother or through clothes or through direct contact, etc.

The symptoms of the disease are those of conjunctival gonorrhoea but they are mild. The cornea may be affected. There will be less inflammation and oedema of the lids. Discharge from the eye is also much less. Prognosis will be good if treatment is started earlier.

Treatment:—It is the same as that of the conjunctivitis gonorrhoea. The eye should be washed thoroughly at frequent intervals with concentrated magsulph, perchloride of mercury 1 in 20,000 or saline or boric lotion. When the oedema decreases, silver nitrate 2% can be applied to the lids daily till all the symptoms and signs subside. If there is a corneal ulcer, atropine drops 1% should be used twice or thrice daily with hot boric fomentations. To prevent adhesions of the lids mild boric ointment or vaseline should be applied to the lids at bed time.

Prophylaxis:—It is very important. All newly born infants should have their eyes cleaned and silver nitrate (5 gr. to 1 oz. of distilled water) instilled into their eyes.

CONJUNCTIVITIS ECZEMATOSA

It is known by various names as Pustular conjunctivitis, Scrofular ophthalmia, or Phlyctenular conjunctivitis. It is characterised by the inflammation of the conjunctiva accompanied by one or more small projections called phlyctenulæs.

Conjunctivitis eczematosa is one of the most common eye diseases of child-hood and youth. Poverty, insanitary surroundings, lack of proper nourishment. and diseases like measles, tuberculosis, and chronic ottorhoea will predispose the attack.

Grayish elevations or nodules about the size of a millet seed appear at some part of the conjunctiva or at the cornea or at the limbus. The nodule is surrounded by an area of conjunctival hyperaemia. The rest of the conjunctiva shows no change. The nodule gradually begins to ulcerate at its apex. In normal cases it heals rapidly within 1 or 2 weeks without leaving behind any changes in the conjunctiva. Most commonly phlyctenulæs at the limbus are common. Some times both the cornea and the conjunctiva are affected. The nodules may become absorbed without going through the stage of ulceration. In severe cases, exudation appears in the deeper layers of the cornea, resulting in destruction. Pannus eczematosa is also common but it is differentiated from that of the trachomatous pannus by its presence at the lower half; or at any place on the margin of the cornea. It is usually thin and scanty in vessels. (Fig No. 6)

Treatment :—General and Local.

General :—Fresh air, good food, avoiding insanitary conditions go a long way in cutting short the course of the disease. Cod-liver-oil, Iron tonics, sun baths or sea baths, if taken regularly, will give wonderful results. The treatment is more general than local and hence the importance of observing the above treatment.

Local :—Dusting the phlyctenulæ with calomel powder daily will act like a specific. The yellow oxide salve should be applied, daily at bed time into the conjunctival sac and the lids are thoroughly massaged. Yellow oxide salve is contra-indicated in extensive corneal ulceration. Calomel dusting is contra-indicated when iodides are taken internally. If the ulcer is spreading, it should be cauterized. If blepharitis accompanies, white precipitate ointment 1 to 2% or icthyol ointment applied to the lids, renders good service. To avoid blepharospasm, instillation of cocaine or dionine drops, or splashing of cold water on the eyelids in the morning will be very effective. Smoked glasses or an eye shade is very useful to wear during the course of treatment.

CHRONIC CATARRHAL CONJUNCTIVITIS

It is a chronic inflammation of the conjunctiva. The most common causes are: (1) The preceding acute

catarrh; (2) The irritating atmosphere such as smoke, dust, heat and impure air; (3) The un-corrected errors as in cases of hypermetropia and astigmatism; (4) The local irritation by a retained foreign body in the conjunctival sac or constant irritation due to trichiasis; and (5) The chronic dacrocystitis.

The conjunctiva of the lid is slightly reddened. The secretion is slightly increased and altered. The eyelids will just stick together by the dried up secretion. Sometimes there might be excoriation at the outer angle and in some cases secretion will be lessened. In old cases the conjunctiva shows hypertrophy.

The symptoms are very characteristic. The patient generally feels heaviness of the lids by the evening and feels sleepy. With a smarting and burning pain of the eyes, the patient feels as if a foreign body is in the eye owing to the presence of mucus under the conjunctiva. There is rapid tyring of the eye and a frequent blinking.

Treatment:—Treatment should be directed first to remove the causative factors. Smoky or dusty atmosphere should be avoided. If any foreign bodies are retained in the conjunctival sac they should be removed. Chronic constipation should be treated. Errors of refraction should be corrected. If the conjunctivits is due to chronic dacrocystitis the sac should be removed. General health should be improved by giving Tonics, out door exercises, etc.

Local:—If there is hypertrophy, silver nitrate solution 2% is the best. It can be touched on the everted lid every alternate day and washed with saline lotion. Otherwise one proceeds with astringent drops such as the zinc, boric, or the alum drops. To avoid sticking of the lids, boric ointment 2% or white precipitate ointment can be applied at bed time to the margins of the eyelids.

Angular Conjunctivitis:—It is characterised by subacute or chronic inflammation of the conjunctiva with redness at the inner and the outer canthus and the bulbar conjunctiva lying adjacent to it. There may be a slight excoriation of the skin adjacent to the affected conjunctiva.

There is a slight pain and the watering of the eye. Sometimes there is mucopurulent discharge. It may lead to chronic blepharitis if the condition is untreated. Hence we often see cases at this stage and often find Blepharitis accompanying the condition.

Nasal catarrh often accompanies the condition. The causative organism is Morax-Axenfeld diplo-bacillus. The disease may extend from the nasal sinus into the conjunctival sac.

Treatment:—Zinc salt is the specific for angular conjunctivitis. Zinc, boric or alum drops dropped into the eye, or an ointment consisting of zinc, boric, icthyal applied to the lids daily at bed time, is a very useful treatment.

FOLLICULAR CONJUNCTIVITIS

It is characterized by the presence of rounded follicles arranged in rows in the lower lid. They are also present in both the fornices. It occurs mostly in young children. Poor hygienic surroundings predispose to the disease. Enlargement of lymphatic glands and adenoids often accompany the disease.

Treatment:—The general condition is to be improved by tonics and cod-liver-oil, fresh air and good food. Avoid unhealthy surroundings. Locally the lids should be touched with 1% silver nitrate solution. In some cases daily application of the yellow oxide of mercury ointment will be useful. Zinc or alum drops may be useful in some cases.

TRACHOMA

It is a granular inflammation of the conjunctiva. It is infectious and generally bilateral. The infection is carried from one eye to the other either directly or indirectly through infected clothes, towels, wash-waters, etc. Insanitary surroundings and over-congestion in sleeping rooms predispose the attack. It is found most frequently in Arabia and Egypt which are considered to be its home. It is more wide-spread in the East than in the West. Switzerland is almost free from this disease. In India Trachoma is moderately prevalent.

The patient complains of photophobia, lacrymation, itching and burning sensation, feeling of a foreign body in the eye and heaviness of the lids.

Swelling of the lids and narrowing of the palpebral aperture are seen. There is a slight ptosis. The conjunctiva of the tarsus as well as of the transition fold is diffused reddened and thickened. The surface is uneven and shows granular appearance. There is a purulent discharge in recent cases and it is less in chronic cases. There are

various clinical forms of trachoma such as the papillary, the granular and the mixed forms.

The papillary form:—With a large number of small elevations on its surface, the conjunctiva gives a velvety appearance. Some times the papiallæ are large. This form is exclusively found on the tarsal conjunctiva and specially of the upper tarsus.

The granular form:—The granules are gray, translucent round follicles showing themselves through the conjunctiva. Their appearances have been compared to that of frog's eyes. They are especially abundant in the two transitional folds of the conjunctiva and rarely on the semilunar folds and the bulbar conjunctiva. (Fig. No. 2)

The Mixed Form:—Both the granular as well as the papillary forms are found in one and the same case.

Course:—The hypertrophy of the conjunctiva progresses up to a certain extent and then it gradually decreases and cicatrization and shrinking appear in its place.

Common complications are:—

1. The Pannus. 2. The Corneal Ulcer.

The Pannus:—It usually covers the upper part of the cornea. In some cases the whole cornea may be involved and in such cases the sight is reduced to mere perception of light. Complete retrogression is also possible and the cornea may again become transparent. (Fig. No. 3)

Ulcers of the Cornea:—They are most common and occur at any place of the cornea. They may appear along with the pannus. In such cases the ulcers are found at the free border of the pannus. The ulcers heal leaving behind small or large opacities. The vision in these cases is reduced according to the density and the extensiveness of the opacities.

Sequelæ:—They are very common, and they are:—

1. Trichiasis and Entropion, 2. Ectropion,
3. Corneal opacities, and 4. Symblepharon.

Treatment:—The treatment takes a very long course. Great patience should be exhibited botl by the Doctor as well as by the patient in continuing the treatment.

No. 1

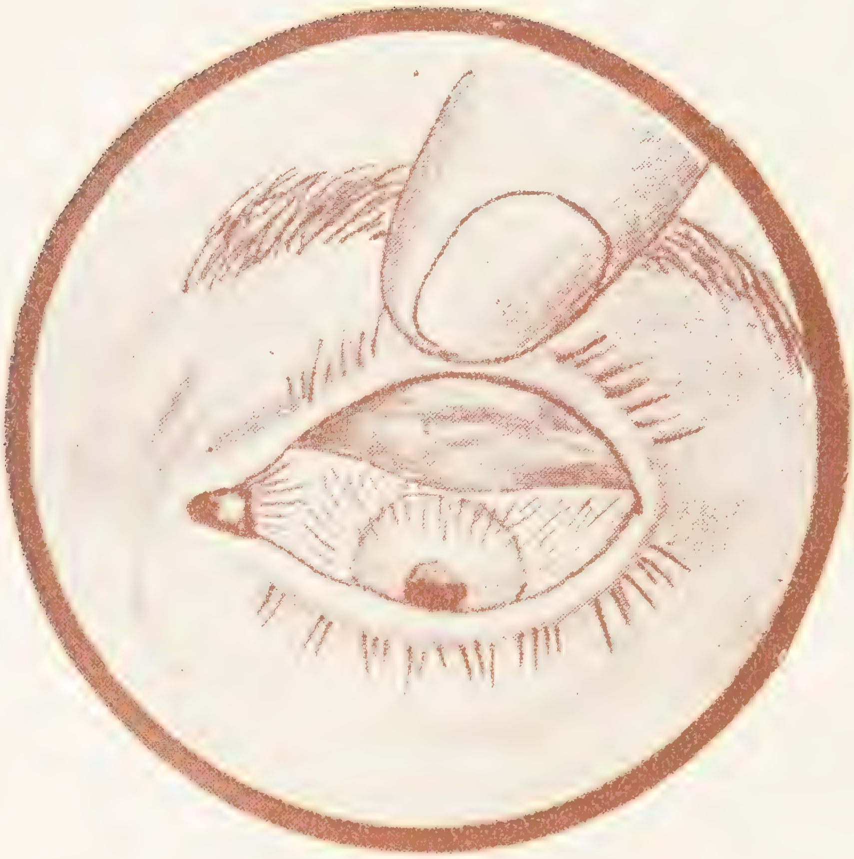
Acute Conjunctivitis

Note the intense conjunctival injection

No. 2

Trachoma

Note the granules on the everted lids



No 3

Trachomatous pannus

Note the vascularisation on the
upper part of the cornea extending upwards

No 4

Symblepharon

Note the fibrous band

Silver nitrate solution is indicated in all fresh cases. It can also be used in fresh progressive corneal ulcers. 2% solution will suffice. Copper sulphate is adopted for those cases in which the irritative phenomena and secretions are slight along with hypertrophy. The presence of corneal ulceration is a contra-indication to the use of copper sulphate. As a rule one should treat a fresh case with silver nitrate solution until the inflammatory appearances diminish considerably. Copper sulphate then takes its place. The touching up must be continued for months or even years till the whole hypertrophy goes away. After touching, the eyes should be washed with normal saline, boric or magsulph. solutions. In the later stages after completing the course, the patient may be given copper citrate ointment for applying once a day. In late stages of trachoma where fibrous bands are present, touching the lids with chaulmoogroil is tried. 1% Hyd. perchloride solution is also tried for touching the lids in cases where silver nitrate failed.

Operative Treatment:—It is particularly indicated in the follicular variety. Excision of the transitional fold of the conjunctiva is a radical method. If there is a marked thickening and degeneration of the tarsus, excision of the tarsus is indicated. The granules may be expressed with Knapp's roller forceps.

Pannus:—In early cases, copper sulphate does some good. But in late stages peritomy is the only procedure.

SILVER IODIDE TREATMENT IN TRACHOMA

It consists of 2 solutions:

No. 1.	Silver Nitrate	1 dr.
	Aqua Distillata	1 dr.
	Glycerine	2 dr.
No. 2.	Pot. Iodide	2 dr.
	Aqua Distillata	2 dr.
	Glycerine	4 dr.

Take one part of No. 1 Solution and mix with two parts of No. 2 Solution. Instil one drop into each eye. There will be smarting sensation lasting only for

4 minutes. Continue this for about one month in the early stages of granular lids. This is found to be more useful than 2% silver nitrate solution.

GLYCERINE COPPER

Copper Sulphate	gr. 4
Glycerine	dr. 4
Aqua Dist.	oz. 1

This is touched over the everted lids specially in chronic stages of Trachoma.

Sulphanilimides in trachoma, and conjunctivitis.

Remarkable results were shown by the administration of the drug in trachoma and its complications specially. 6 Tablets of 7½ gr. each are given daily for a week, supplemented with local treatment of the drug by applying in the form of an eye ointment (6% sulphanalimide).

M & B 693 is found to be very useful in Ophthalmia due to Pneumococci and Gonococci. Daily 6 tablets are given for 4 days and continued if necessary.

Tartar Emetic: 5 cc. of 1% solution given intra venously for about dozen times at intervals is found to be very useful in trachoma with corneal complications.

Quinine Treatment in trachoma.

10% solution of quinine Bisulphate when touched continuously for 1 to 2 months, is found to be more useful than Silver Nitrate and Copper.

Guaicol Cacodylate: 2% solution is injected sub-conjunctively in Phlyctenular ulcers of the cornea and conjunctiva.

DISEASES OF THE CONJUNCTIVA AS DESCRIBED BY SUSRUTA IN THE PREHISTORIC AGE

1. Vartma-bandha (Acute conjunctivitis) characterised by swelling of the eyelids accompanied with an itching sensation and slight pain.

2. Lagana (Papillary conjunctivitis)—a thick, slimy, hard, painless, nodular swelling of the eyelid, resembling a kola fruit (*Zizyphus juzuba*) in size and characterised by an itching sensation and absence of suppuration.

3. Visa-vartma (Eczematous conjunctivitis) an inflammatory swelling of the eyelid dotted with minute punctures, like the pores in the stem of a water-soaked lotus.

4. Anjana (copper-coloured pustules in the conjunctiva) characterised by the presence of small, soft, copper-coloured pustules in the eyelid and attended with a burning and pricking sensation and a little pain.

5. Bahala-vartma (Phlegmonous conjunctivitis) vegetations of pustules (pidaka) all of equal size, occurring all along the eyelid and resembling it in colour.

6. Pariklinna-vartma (Xerosis conjunctivitis) marked by the sticking together of the eyelids, even in the absence of any suppuration and in spite of constant lavage of the eye.

7. Klisto-vartma (angioneurotic oedema of the eyelids) marked by a mild copper-coloured inflammatory swelling of both eyelids simultaneously accompanied by a slight pain and with sudden discharge of blood.

8. Pothaki (Follicular conjunctivitis) characterised by the presence of a number of red, heavy papules resembling red mustard seeds, accompanied with pain, itching and inflammatory exudation.

9. Vartma-sarkara (Ulcerative pustular conjunctivitis) marked by the presence of rough, large pustules surrounded by small, thick, erythematous pustules covering the entire surface of the eyelid.

10. Arso-vartma (Trachoma) characterised by the presence of vegetations of small, discrete, rough, papillae on the eyelid, attended with little pain.

11. Suskarsas (Granular conjunctivitis) marked by long, rough, hard, numbed papillae (ankura) on the eyelid.

Susruta described four distinct types of ophthalmia (abhisyanda) characterised by the following symptoms—

(*a*) Vataja abhisyanda (ophthalmia of neural origin) marked by numbness, pricking pain, horripilation, roughness and dryness of the eye, cold lachrymation and headache.

(*b*) Pittaja abhisyanda (due to metabolic or biliary derangement) characteristic symptoms being burning sensation and inflammation of the bulbar and palpebral conjunctiva, a longing for cold application on the eyes, excessive hot lacrimation, cloudly vision and yellowness of the eyes.

(*c*) Kaphaja abhisyanda (due to derangement of the lymph) marked by a longing for hot applications in the eye, accompanied with a feeling of heaviness, an itching sensation, swelling, excessive whiteness, and a constant deposit of slimy mucus.

(*d*) Raktaja abhisyanda (ophthalmia due to disturbance of the blood) characterised by redness of the eyes, a flow of copper-coloured tears, as in the type of pittaja abhisyanda, and the presence of deep red vascularisation all round (ciliary injection).

According to Susrutian teachings, the common predisposing signs and symptoms of the various ocular diseases are—cloudiness of vision, inflammation of the eyelid, lachrymation, accumulation of mucus, heaviness, burning sensation, sucking pain and redness of the eyes. In the case of inflammation of the eyelids, the eye feels as if it were studded with bristles; there is felt a pricking pain and the patient becomes conscious of an impairment in the faculty of discerning colours and experiences difficulty in the normal closing and opening of the eyelids.

As for the etiology, Susruta taught that the intra-ocular and bodily humours become upset and unhinged by the following factors and cause disorders to the organ of vision. Diving in water immediately after being exposed to heat and glare of sun; prolonged gazing at distant objects; sleeping during the day and waking up late at night, continued excessive weeping, over indulgence in grief and rage, bodily shock or injury, indulgence in sexual excesses; partaking of fermented rice water, acid gruel; Masa pulse (Phaseolus radiatus), and kulattha pulse (Dolichos biflorus), voluntary repression of natural urgings: exposure of the eye to smoke and dust, trickling of sweat into the eyes; excessive or suppressed vomiting; suppression of tears; constant and repeated contractions of the eyes to adjust the sight to accommodate small objects.

Susruta also taught that the diseases of the eyelid attack both the young as well as the old; poor hygienic conditions and certain climatic conditions predispose to the incidence of the disease. The contagiousness of these ocular affections were known to the ancient ophthalmologists.

The Susrutian principles of treatment are:—the simple maxim to be adopted by the eye surgeon is to avoid and carefully guard against the primary factors predisposing to the disease. Special elaborate remedial measures are to be employed in order to soothe the bodily humours as also to counteract the concomitant complications.

As a general preliminary measure to the treatment of eye disease, Susruta wisely ordains that a decoction of emetics and purgatives be administered to the patient for the elimination of bodily toxins and the pacification of deranged bodily humours.

Very much like the modern ophthalmologist, Susruta advises washing the affected organ with antiphlogistic astringents and antiseptic eye-lotions such as those of Daruharidra (Berberis asiatica). Saindhava (Sodium chloride) and triphala (Terminalia chebula. Terminalia belirica and Embilica officinalis), compresses (sveda), eye-lotions (aschyotana), anjana (ointments). pralepa (application of medicinal plaster), upanaha (poultice), cauterisation and venesection, and administration of snuff (nasya) are among other general measures to be adopted in the treatment of eye diseases. The use of silver, gold, copper, bell-metal, mercury, zinc, etc., in ocular therapeutics, has been in vogue ever since the hoary prehistoric Susrutian period, and the Ayurvedic *materia medica* is very emphatic regarding the efficacious antiseptic, and tonic properties of these drugs in the treatment of ocular affections.

As part of general treatment, Susruta insisted upon the patient having a nutritious and energising diet, such as fresh milk, fruits and other vitamenous food-stuffs, as also enjoyment of fresh air.

Of the various eye diseases Susruta directed that:— arsovartma (Trachoma), and suskarasas (granular conjunctivitis) are to be treated surgically by chhedana (excision) besides the routine medicinal therapy of eyewashes, compresses and application of ointments, etc., while Bahalavartma (phlegmonous conjunctivitis), klisto-vartma (angeioneurotic œdema of the eyelid), Vartma-bandha (acute conjunctivitis), Pothaki (follicular conjunctivitis) and Vartma—sarkara (ulcerative pustular conjunctiva) are to be treated by

lekhana (scarification); and lagana (a hard papillary form of conjunctivitis), Visa-vartma (Conjunctivitis eczematosa) and anjana (copper-coloured pustules on the conjunctiva) are to be treated by Chedana (incision) operation.

Susruta's instructions with regard to the lekhana (scarification) operation are briefly outlined below:—

After having treated with sneha-karma (proper emulsive measures) and subjected him to a course of emetics and purgatives, the patient should be laid in a chamber free from the exposure of the sun and the blasts of the wind. The surgeon should evert the eyelid of the patient with his thumb and index finger and then foment the affected part with a piece of linen soaked in warm water and squeezed. Care should be taken that the eyelid is to be everted with the lint-covered indexed finger and thumb in such a delicate manner that the lid does not tremble or droop down. It should be kept steady and firm. Having done this, the eyelid is to be rubbed with a piece of clean linen and judiciously scarified and scrubbed with a lekhana sastra (scarifying knife, vrihimukha sastra) or with help of a sephalika leaf (Nyctanthes arbortristis). After bleeding has ceased, the operated part should be thoroughly fomented and carefully rubbed with a medicinal compound consisting of trikatu (red pepper, ginger and black pepper), kasisa (ferrous sulphate), manahsila (realgar), anjana (black antimony), saindhava salt (sodium chloride) and swarna maksika (copper pyrites) taken in equal parts and finely pounded together. Then the part should be washed with luke-warm water and lubricated with clarified butter. The after treatment would be like that of ulcer treatment. After 3 days, the surgeon should prescribe fomentations. In the cases of Vartma bandha (Acute conjunctivitis), Klisto-vartma (angeioneurotic oedema of the lid), Bahala-vartma (Phlegmonous conjunctivitis) and Pothaki (Follicular conjunctivitis), the surgeon should first scrape the eyelid gently and cautiously and then scarify the same with the vrihimukha sastra (scarifying knife).

For the surgical treatment of Vartma-sarkara (ulcerative pustular conjunctivitis) the affected part should be cut with the vriddhipatra sastra (cutting knife or scalpel) and then carefully and gently scarified with the vrihimukha sastra (scarifying knife).

In the case of the treatment of Visagranthe (Eczematous conjunctivitis of the suppurative type visa-vartma) the surgeon should first foment the eyelid and then taking a vrihimukha

FIG. 1. VRIHIMUKHA SASTRA

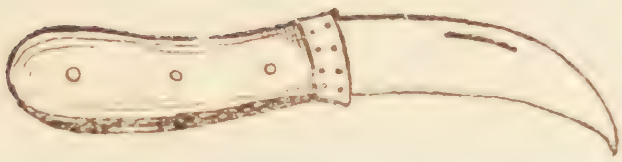


FIG. 2. VRDDHIPATRA SASTRA

FIG. 3. SUSRUTA'S VETASAPATRA SASTRA

FIG. 5. SUSRUTA'S VADISA JANTRA

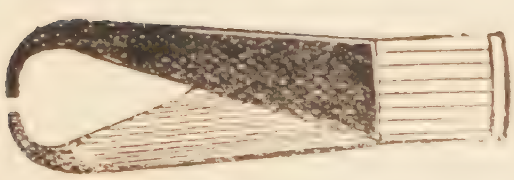


FIG. 6. SUSRUTA'S MUCHUNDI JANTRA

FIG. 8. SUSRUTA'S MANDALAGRA SASTRA

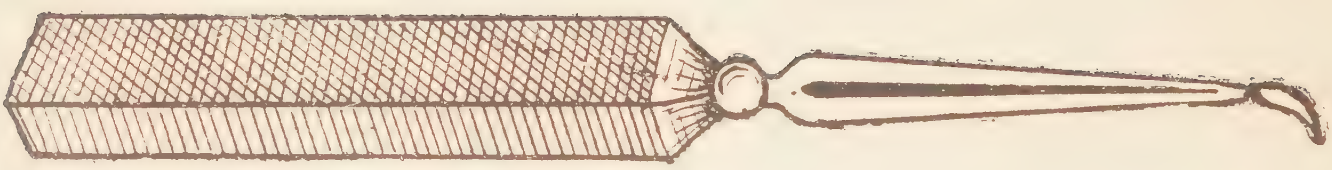


FIG. 9. SUSRUTA'S JABAMUKHI SALOKA

(Carley-mouthed needle)

FIG. 11. SUSRUTA'S PAKSMAKOPA SAMDANSA

(Epilation forceps)

[*To face page 23*

sastra completely incise the puncture like pores of the eyelid. Thereafter the affected lid would be dusted over with a pulverised compound of saindhava salt (Sodium chloride), kasisa (Ferrous sulphate), magadhi (Piper longum), manahsila (Realgar) and ela (large cardamom seeds). Honey and clarified butter are to be applied over the dusted part and it should be lightly bandaged for the complete union of the parts.

For the treatment of anjana (copper-coloured pustules in the conjunctiva) the affected part of the eyelid is to be properly fomented, and in case of there being spontaneous rupture of a pustule, it should be well pressed and rubbed (pratisarana) with a compound of manahsila, ela, saindhava salt and tagarapaduka (Valeriana hardwicitrii) pasted together with honey. If, on the other hand, there are indications for opening pustule, it should be rubbed with honey and rasanjana (extract of Berberis asiatica) and then coated with a warm collyrium made with lampblack prepared from a burning lamp-flame.

In case of the treatment of lagana (Papillar conjunctivitis) and arso-vartma (Trachoma) and suskarsas (granular conjunctivitis) which are surgically treated by incision (bhedana) and excision (chhedana) respectively, any of the following agents rochana (Mallotus phillipensis), yavaksara (Pottassium bicarbonate), tuttha (Cupric sulphate), pippali (Piper longum) and honey should be applied to the operated part, while in serious cases cauterisation with alkali or with fire should be the remedy.

Moreover in case of Arso-vartma and Suskarasas, besides surgical measures, application of copper sulphate ointment and massage with medicinal powders such as lekhana churna and washing the organ with astringent and antiseptic lotions are advocated. Lekhana churna (scarifying powder) is prepared from a pulverised compound of samkha (conch-shell), samudraphena (Sepia officinalis), marine oystershell, crystal, ruby, coral, asmantaka (jewel), vaidurya (Lapis lazuli), pearl, iron, copper and srotanyana (antimony), all taken in equal parts. The lekhana churna is to be stocked in a ram's horn and applied to the affected portion of the eye every morning and evening. Such applications are extremely efficacious in the treatment of Arso-vartma and Suskarsas.

For the treatment of Xerosis conjunctivitis (Pariklinna-vartma) Susruta prescribes vitaminous food-stuffs for internal administration and vitimanized oleagiuous ointments for local application.

Treatment of Vataja Abhisyanda (ophthalmia due to nervous disorders) and adhimantha (Uveitis). The main principles of treatment as advocated by Susruta are indicated below:—The patient should first be treated with mature old clarified butter. The affected eye is to be duly compressed and then venesection is to be resorted to by the surgeon. The patient's body should be only cleansed internally by effecting full purging with the help of a sneha-vasti (oleaginous enema) and the following remedial measures are to be administered according to the indications—sechana (eye wash), aschyotana (eye-lotion), sveda (compress), upanaha (poultice), tarpana (soothing medication), putaparka, pralepa (plaster), internal administration of milk, medicated ghrita (clarified butter) and other vitiminised food-stuffs.

Eye-washes are given with warm decoction of drugs possessing antiseptic, sedative and antiphlogistic properties or with the decoction prepared from the flesh of any aquatic animal or of one frequenting marshy places.

The roots, leaves or bark of Eranda plants (Ricinus communis) or the roots of Kantakari (Solanum xanthocarpum) should be boiled with the milk of a she-goat and made into an infusion, which should be used, while warm, in washing the organ.

A liquid compound containing half milk and half water, and boiled together with saindhava, yastimadhu (liquorice) and pippali (long pepper) and vala (Pavonia odorata) should be utilized as eye-wash and eye-lotion.

A compound consisting of clarified butter, curd, fat and marrow should be prepared luke-warm and applied to the effected organ and lint soaked in the same is to be covered over the eye.

A liquid compound prepared from the milk, meat extract, porridge (payasa) should be employed in poulticing the effected organ.

A liquid compound consisting of the milk of a she-goat diluted with water and boiled with admixture of Hrivera (Pavoina odorata), tagara (Valeriana hardwicitrii), Cordifolia manjistha (Rubia cordifolia), and udumbara barks (Ficus glomerata) is considered to be the best eyedrop in case of there being intolerable pain (sula) in the eye.

Oil properly cooked with sthira (Desmodium gangaticum), milk and drugs of the sweet group (glycerrhiza, for instance) is to be profitably employed in the form of a snuff (nasya).

Anjana-yastimadhu, haridra (Curcuma longa), haritaki (Terminalia chebula) and devadaru (Pinus deodara) all taken in equal parts—are to be pasted with the milk of a she-goat. This is very highly efficacious in abhisyanda (ophthalmia) as well as in adhimantha (uveitis).

Gutika-anjana—Gairika (red ochre), saindhava, pippali, and sunthi (dry gingiber) the quantity of each succeeding drug being double that of the one preceding it, are to be pasted with pure water and fashioned into a tabloid form and used effectively in abhisyanda (ophthalmia) and adhimantha (uveitis).

Diet:—Susruta prescribed vitamin intake in the shape of fresh milk, medicated milk as well as medicated clarified butter. The patient should be given simple, light and non stimulating diet.

After food, the patient is to be given either a portion of ghrta (clarified butter) cooked with decoction of triphla or simply old and matured ghrta. He also advised that the patient should be given milk cooked with drugs of the sedative (vayu subduing group) or of the vitamin (jibaniya) group.

Principles of the treatment of raktaja (blood originated) abhisyanda and adhimantha (uveitis)—the patient having been treated with old and matured clarified butter, venesection with a vetasapatra jantra (puncturing instrument) or by application of leeches should be resorted to. Thereafter eliminating the bodily toxins by sufficient purging, an errhine (siro-vasti) composed of clarified butter mixed with sugar should be prescribed for the pacification of the deranged humors of the head.

The physician should afterwards prescribe pralepa (plasters), pariseka (eyewashes), aschyotana (eyelotions), abhyanjana (application of ointment), nasya (snuff), dhuma (fumigation), and tarpana (sedative medicaments) according to the necessary indications of the affection.

Pralepa—a warm medicinal plaster compound of decoction of Nilotpala (Nelumbium speciosum), Usira (root of fragrant grass), Daruharidra (Berberis asiatica), Musta (Cyprus rotundus), Kaleya (Santalum album.) and yastimadhu (glycerrhiza), and lodhra (Symblocos racemosa) taken in equal parts and boiled with clarified butter duly washed should be applied round the affected eye as a pralepa.

Mild fomentations, as also venesection by application of leeches are indicated in case of there being intolerable pain. Susruta also prescribes large doses of clarified butter as a sedative for the alleviation of intolerable pain.

Aschyotana—Rain water mixed with pulverised kaseru (Scripus gressus), and yastimadhu should be squeezed through a sterile piece of lint into the affected organ as an eye-lotion.

Anjana—Manjistha (Rubia cordifolia), flowers of patala (Stereospermum suaveolens), arjuna (Terminalia arjuna), Sriparni (Gmelina arboria), Dhataki (Wood fordia floriovunda); amalaki (Embelica officinalis), Brihati (Solanum indicum), kantakari (Solanum xanthocarpum) and Bimbilot (Cephalandra indica) are to be taken in equal parts and powdered and pasted together with honey or with the expressed juice of sugarcane. Susruta extolls this anjana as being highly efficacious in blood originated ophthalmia and uveitis.

A varti anjana (ointment stick) prepared from a compound of equal parts of raktachandana (red sandal wood) kumuda (Nymphaea stellatta), tejapatra (Lourus cassia), silajatu (asphalt), kumkuma (saffron), powders of iron, copper, copper sulphate, lead, bell-metal, rasanjana (extract of Berberis asiatica), and the resenous exudation of a nimba tree (Melia azadirachta) taken in equal parts and pounded and pasted together in water and made into a varti (stick). This vartianjana, possessing as it does lekhana (scarifying) properties, is very efficacious in blood-originated ophthalmia and uveitis.

Treatment of kaphaja abhisyanda (ophthalmia due to lymphatic derangement) and adhimantha (uveitis). During the acute stage kaphaja abhisyanda and adhimantha are to be treated with venesection first, and thereafter compresses, eye-washes, aschyotana, dhuma (fumigation), nasya (snuff), pralepa, tarpana (sedative medicaments) and application of anjana are to be employed according to the requirements. Continuously for three days the patient is to be purged for the elimination of bodily toxins, after which he should be given ghrta (clarified butter) properly cooked with one of the bitter drugs (Berberis asiatica, saffron, etc.) in the morning and his diet would consist of such articles as would tend to appease the deranged humours.

Compresses with the warm decoction made from the tender twigs or leaves of tagara (Valeriana hardwicitrii),

kanchana (Bauhinia variegata), tulasi (Ocimum album), vilwa (Aegle marmelose), Salincha (alternanthera sessilis), pilu (Salvadora persica), Akanda (Calotropis gigantea), kapittha (Feronia elephantum) are to be regularly given. Thereafter a plaster composed of vala (Pavonia odorato), Sunthi (dry gingiber), Devadaru (Pinus deodara), and khuda (suasurea lappa) should be applied round the supraorbital region of the head.

Vartianjana—this is made from equal parts of saindhava, Hingu (Dikamallegum gummy gardinia), triphala, yastimadhu, pundariyakstha (root stock of Nymphoea lotus), rasanjana, tuttha and copper—all these having been duly pounded and pasted together with water, and fashioned into a varti ; or from Vala, kudha, devadaru, pulverised samkha (conchshell), aknadi (Cissampelos pareira), chita (Plumbago zeylanica), trikatu (Piper longum, dry ginger and black pepper), and manahsila (realgar) pasted together with water, or from the flowers and fruits of sajina (Morniga plerygosperma), and Brihati (Solanum indicum), and kantakari (Solanum xanthocarpum) pounded and pasted together and rolled into a varti. All these anjanas are very useful in kaphaja eye diseases.

Treatment of pittaja abhisyanda (ophthalmia due to billiary or metabolic disorders) and adhimantha (uveitis.)

A compound of Gundra (Mariscus cyprus), Saliroot (root of Oriza sativa), Saivala (Pistia stratiotes), Sailabhedi (Colensamboinicus), daruharidra, sugarcane, Ela, utpala, Lodhra, Vetasa (Calamus rotang), Draksa (grape), madhu (honey), sandalwood, yastimadhu, Haridra (saffron), anantamula (Indian sarsaparilla) are to be mixed in equal parts with breast-milk and boiled together with the clarified butter. This ghrta is to be locally employed as a sedative medicament (tarpana) or as snuff or all the above medical compounds are to be only boiled with goat's milk and used locally on the effected eye as a sedative.

A combination of talisi—patra (Pinus webbiana), ela (larger cardamom), gairika (red ochre), usira (root of fragrant grass), Samkha—all these taken in equal parts pasted with breast-milk should be used as an anjana.

Gold leaf rubbed with breast-milk or the flowers of kinsuka (Butea frondosa) rubbed with honey, or of a compound of Modhra (Symblocos racemosa), draksa, sugar, utpala, vacha (sweet flag), and yastimadhu rubbed with breast-milk should be used as an anjana in pittaja ophthalmia and adhimantha (uveitis).

Treatment of Subconjunctival Haemorrhage:—Susruta treated this condition by the sprinkling of breast-milk, which has a haemostatic action; indeed breast-milk was the adrenalin of the pre-adrenalin days.

Injuries of the Conjunctiva:—Caused by exposure to smoke, dust, injuries, burns and foreign bodies.

Treatment:—Foreign bodies are removed by salaka; in case of iron particles, they are removed by the magnet (Ayaskanta), because magnet was known to the ancient Hindus and they used it to extract minute foreign bodies such as iron particles from the eyes and teeth.

Spring Catarrh or Vernal Catarrh:—It is a chronic disease characterized by the appearance of peculiar papillæ on the tarsal or the bulbar conjunctiva. It is most common in children and specially in school boys. The disease is prevalent in the summer season and almost comes to a stand still in winter. Endocrine inbalance and calcium deficiency play a great part in the etiology of the disease.

It is mainly of two types, the palpebral and limbal or it may be mixed. In the palpebral type the tarsal conjunctiva shows flattened papillæ and is covered by a delicate bluish white film. In the limbal type pale grayish nodes appear on either side of the limbus. The rest of the conjunctiva is not affected. The changes are markedly seen during the summer and get lessened or disappear completely during the winter.

Lacrymation, photophobia, itching and the feeling of heat in the eyes are the most common symptoms. Eosinophiles are found in the discharge.

Treatment:—There is no specific cure. The subjective symptoms can be relieved to some extent by putting acetic acid drops into the eye (one drop of dilute acid to $\frac{1}{4}$ oz. of water). Salicylic acid ointment 1% is also used. Itching and photophobia can be relieved to a great extent by holacaine drops or adrenalin or xeroform or the use of cold compresses and the wearing of smoked glasses. For the limbal growth, massage with white precipitate ointment may be used. If the patient is pale with enlargement of glands, iron and arsenic may be administered internally. It is highly advisable for these patients to keep themselves in cool place specially in summer. They should have daily cold baths and cold douches for the eyes during the summer season. Some cases are being reported favourably with radium treatment.

Spring Catarrh (*Kukunaka*):—According to Susruta it is an inflammatory disease of the eyelids affecting mostly boys and young children, characterised by excessive and intolerable itching (kanduyana), photophobia and lachrymation. Susruta taught that besides toxins elaborated from dietetic disorders, sunlight is the main exciting factor in the causation of the disease. The disease becomes exaggerated in the hot days and subsides in the cool days. The disease, according to Susruta, is a curable one. As for the treatment, Susruta prescribed venesection in acute exacerbations of the disease, scarification and expression of the eyelid with a lekhana sastra (scarifying instrument) or with a sephalika leaf (Nyctanthes Arbortristis), as also protection of the eye from exposure to light and sun's rays. Washing of the eye with mild astringent lotions and application of ointments for the relief of itching are also recommended.

The following anjanas are recommended for use in spring catarrh. An anjana prepared from a compound of manahsila (realgar), maricha (Piper nigram), samkha (conch-shell), rasanjana (extract of Berberis asiatica), saindhava, all these pounded together and pasted with treacle and honey; an anjana prepared from a compound of neem leaves, yastimadhu, Daruharidra (Berberis asiatica), powders of copper, and lodhra (Symblocos recemosa) all these taken in equal parts and made it into a paste with water or honey.

Astringent decoctions made from the leaves of amalaka (Embelica officinalis), and asmantaka (wood sorrel) should be used in eyewash and compress. Clarified butter boiled with decoction of triphala or gulancha (Tinospora cordifolia) should be used as aschyotana (eye-lotion) in this disease.

Pterygium:—It is a triangular fold of the membrane extending from the inner or outer part of the ocular conjunctiva to the cornea. The apex is immovably united to the cornea while the base merges with the conjunctiva. It is common in elderly persons who are exposed to wind, dust and smoky atmosphere. Generally well-to-do people are devoid of the disease.

Pterygium, if recent, is red in colour, owing to its rich blood supply but may turn later on into white tendinous membrane. If it extends to the cornea, it causes irritation of the eye and watering. If it overlaps the cornea the sight is also interfered with. It may occur in one eye or in both the eyes. (Fig. No. 5)

Treatment:—Operative procedure is the only course. The pterygium may be dissected away with a sharp knife and cut off with a scissors. The conjunctival defect is closed by uniting the upper and lower borders. If the pterygium extends on to the cornea, it is completely excised and the cornea should be scraped at its attachment, so as to prevent recurrences. Some surgeons instead of cutting the pterygium, dissect it and bury it under the undermined conjunctiva. This procedure is more successful than the previous one. Application of carbon dioxide and radium will be useful in some persistent cases.

Pterygium (Arman) and its treatment:—The armans (pterygia), according to the Susrutian teachings occur on the sclerotic region of the eye, and are of five distinct varieties, namely:—

1. Prastayarma (pterygium crassum of Fuchs) characterised by the presence of an extensive, thin, slightly bluish red fleshy membrane on the scleral conjunctivitis.

2. Suklarma (pterygium album)—it is a soft, slowly growing, white, plain membrane of the sclera.

3. Raktarma (pterygium vasculosum of Fuchs) a fibro vascular membrane on the sclerotic coat, the colour of a red lotus is known as raktarma.

4. Adhimansarma (pterygium carnosum of Fuchs) marked by the presence of an extensive, soft, thick, succulent, liver coloured fleshy membrane.

5. Snayarma (pterygium tenue membranaceae of Fuchs) marked by the presence of a rough, grayish, fibro fleshy patch, growing slowly in size.

The technic of surgical treatment of pterygium as directed by Susruta in the pre-historic age is almost like the modern surgical excision of the pterygium.

SUB-CONJUNCTIVAL HAEMORRHAGE

Sub-conjunctival hæmorrhages are seen as bright or dark red patches under the bulbar conjunctiva. No inflammatory symptoms are seen. It is as result of (1) Injuries either local or at the base of the skull, (2) Operations on the eyeball, (3) Inflammation of the eyeball, (4) Result of whooping-cough, and (5) the result of breaking of vessels in cases of arterio-sclerosis. (Fig. No. 3)

No. 5
Pterygium

No. 6
Conjunctivitis Eczematosa
Note the phlyctenulæ on the cornea and conjunctiva

No. 7

Corneal ulcer with Circum corneal injection

No. 8

Irido-Cyclitis with pus in the
Anterior Chamber
Note the intense ciliary injection

Treatment:—The eye is to be kept at rest. The blood by itself absorbs in due course. Dionine 5% may be dropped into the eye to hasten absorption. Side by side the causative factor such as whooping-cough or arterio-sclerosis should be attended to.

Susruta treated this condition by the sprinkling of breast-milk, which has a haemostatic action, indeed breast-milk was the adrenalin of the pre-adrenalin days.

SYMBLEPHARON

It is a cicatrical attachment between the conjunctiva of the lid and the eyeball. This is as a result of apposition of two granulating surfaces. There are three varieties: S. anterior, S. posterior, and S. Totale. It is called S. Anterior when it extends from the lid to the globe leaving a free portion of the conjunctiva corresponding to the fornix; S. Posterior when it involves only the fornix, and S. Totale when there is a total growing together of the lid and bulb. (Fig. No. 4)

Treatment:—It is exclusively operative. The operation consists in separating the bulb from the adjacent lid by means of a scissors, preventing reunion by placing a graft or an oil cloth placed between the two granulating surfaces and allowing the granulating surfaces to heal separately.

INJURIES OF THE CONJUNCTIVA

They are very common and are caused by foreign bodies, burns and wounds.

Foreign Bodies:—The most common foreign bodies are coal and dust. Generally they lie on the inner surface of the upper lid, and rub the cornea giving rise to great pain and irritation. They can easily be removed by a spud after everting the lid. After removal, the eye should be washed thoroughly and some antiseptic drops instilled into the eye. Foreign bodies, which are big, may be removed with a fine Graefe's cataract knife.

Burns:—These are caused by steam or boiling water, acids, lime or molten lead, etc. As a result deep wounds are formed—resulting in scars later on. The treatment consists in removing the caustic substance and washing the eye thoroughly. Atropine is dropped into the eye if there is corneal ulceration. Care should be taken to see that no adhesion forms between the bulb and the conjunctiva during the course of healing.

DISEASES OF THE CORNEA

Ulcer Cornea:—An ulcer is a common inflammation of the cornea. It is an infiltration followed by suppuration and loss of substance of the cornea. (Fig. No. 7)

Ulcers of the cornea are most common in adults. They are generally due to infection by micro-organisms such as pneumococci, streptococci, staphlococci, derived from the conjunctival sac or from the tear sac. The exciting causes are: (1) traumatism-injuries and foreign bodies. (2) conjunctival inflammation, (3) keratomalacia; (4) operation, (5) herpes, and (6) variola.

Pain, photophobia, blepharospasm and lacrymation are the common symptoms. These depend upon the severity of the inflammation.

The ulcer-cornea begins at first with a dull grayish or grayish yellow infiltration of a circumscribed portion of the cornea. Then suppuration takes place in the area. The superficial layers are cast off and result in loss of the substance of the cornea. The ulcer remains as it is, or it may spread either covering a large space of the cornea, or deeply or both in area and in depth. Very often the advance takes place across the cornea. In serpiginous or creeping ulcer, one edge of the ulcer will be progressing while the other edge will be healing. The area surrounding the ulcer will be deeply infiltrated and presents circum-corneal injection. If the ulcer is small and superficial and if only the superficial epithelium is involved, healing takes place soon. The destroyed portion of the cornea will be cast off, the infiltrated border will become clean and repair sets in. The cornea gets transparent within a short time. But if the proper substance of the cornea is involved, a new connective tissue is formed over the area resulting in a scar. The scar is either thin or thick according to the condition of inflammation. It forms a white opacity with a slight depression over the area.

If the deep layers of the cornea are involved, the subjective and objective symptoms are aggravated, accompanied by iritis and cyclitis. When there is a severe iridocyclitis, exudation begins to pour into the anterior chamber. This is either muco-purulent or purulent. Thus pus is present in the anterior chamber and is known as hypopyon. It collects at the bottom of the anterior chamber which may get absorbed completely within a sharp space of time leaving the anterior chamber quite normal. Sometimes

due to the increased exudate the tension becomes great resulting in bulging forwards of the cornea (keratectasia).

Perforation of the cornea is often preceded by a bulging of the descemet's membrane, through the floor of the ulcer. Perforation may be due to various reasons. It may arise as a result of the increase of pressure due to blepharospasm, or various straining efforts such as crying, sneezing, coughing, etc.

When once perforation occurs, the aqueous begins to escape and carries the iris with it into the wound. Owing to the loss of tension, the eyeball feels soft. The anterior chamber is obliterated. The iris and sometimes the lens comes forwards in apposition with the cornea. Perforation of the cornea hastens the healing of the ulcer. A few days after perforation the perforated opening begins to close by the process of cicatrization and nothing is seen except an opacity in front. But generally the iris remains adherent to the walls of the perforation or remains prolapsed and becomes incorporated with the scar. The condition is known as the anterior synechia. If there is a dense cicatrix, forming a white opacity and the iris is adherent to it, it is known as the adherent leucoma.

Occasionally the perforation fails to close and a corneal fistula remains resulting in the complete oblitration of the anterior chamber. The eye finally becomes soft. This condition exposes the eye to severe inflammation such as iritis, iridocyclitis or even panophthalmitis.

Treatment:—General and local.

General:—If the general condition is below par, it should be improved by giving tonics, fresh air, good food, etc. If the ulcer is due to a foreign body it should be removed. If it is due to dacrocystitis the sac should be removed at first. If the trouble is due to a septic tooth or a septic tonsil or sepsis anywhere in the body, the root cause should at first be attended to. Chronic constipation should be relieved and free purgatives should be given. If there is much pain and sleeplessness, aspirine or salicylates in large quantities can be given safely.

Local treatment includes instillation of atropine drops, hot compresses, bandaging, irrigation with antiseptic solutions, cauterization of the ulcer, and parcentesis of the cornea. These different methods are being used at different stages and in different cases. In a case of ulcer associated

with conjunctival inflammation touching the lid with silver nitrate 2% and washing with warm boric or saline lotion will be very effective.

Atropine acts like a specific in corneal ulceration. It may be dropped into the eye either once or twice or any number of times according to the severity of inflammation. In peripheral ulcers of the cornea, eserine will be useful. In some rare cases atropine causes œdema and eczema of the lids and in such cases it should be stopped and replaced by another drug.

Bandaging:—This is very useful when there is a deep corneal ulceration and when there is a threatening perforation of the cornea. The object of bandaging is to give rest and support to the eye. It is contraindicated in cases where there is an excessive discharge from the conjunctiva.

Cauterization is very effective. This is done generally with a match stick dipped in Tr. iodine or carbolic acid, or with the help of a galvanic cautery. The eye should be cocainized before cauterizing.

The ulcer can be scraped with a sharp spoon in some resisting cases.

Brushing the ulcer with idoform powder is advocated in some septic ulcers.

Paracentesis of the cornea is another useful method.

When the iris is prolapsed, excision is indicated. The tip of the prolapsed iris is caught with an iris forceps and is cut closely to the cornea by a Dewecker's scissors. But the excision of the iris is contraindicated in cases of large prolapse, when the ulcer is active and progressing, when the conjunctiva contains virulent organisms and when the prolapse is older than one week. Old and extensive prolapses, if they are interfered with, result in a corneal fistula. Therefore old prolapses should not be tackled but left alone. For a corneal fistula, treatment should be on the lines of getting a flat scar at the area of the fistula. This can be done by repeatedly cauterizing the area of the fistula. If the ulcer is regressive without perforation, it can be treated with calomel dusting and dionine drops or the eye may be massaged with yellow salve so as to stimulate the filling out of the loss of substance with the scar tissue.

Ulcer rodens:—A vigorous burning of the undermined border with a galvanic cautery is the best method. An application of carbondioxide snow and radium for a few seconds is advocated by some surgeons. But on the whole the results are not very satisfactory.

Ulcer serpens:—In addition to atropine, bandaging and warm applications, cauterization with a galvanic cautery or steam, are also advocated. Serum therapy is advocated by some surgeons. 50 c. c. of Roemer's pneumococcus serum is injected beneath the conjunctiva. The serum may also be dropped into the eye. At first a terrible reaction comes in, but in a day or two it subsides giving excellent results. The injection may be repeated, if necessary.

1% solution of optochinum hydrochloricum is also very useful. The ulcer may be touched with the solution. Later on ½% solution may be dropped into the eye, every two hours, till all the symptoms subside.

In extensive ulcers, Sæmisch's incision is advocated.

KERATITIS LAGOPHTHALMUS

It arises from defective covering of the cornea by the lid. Under such circumstances the cornea becomes dry, dessicated and later on infiltrated and ulcerated.

Treatment:—The cause of lagophthalmus should be attended to.

KERATITIS PUNCTATA SUPERFICIALIS

It is characterized by presenting small numerous gray spots in the superficial layers of the cornea beneath the Bowman's membrane. The disease always starts like acute catarrhal conjunctivitis. Generally it is often mistaken for acute catarrh. It often accompanies respiratory troubles. It is generally common in young people, always bilateral, and lasts for several months.

Treatment:—Atropine, hot compresses, smoked glasses and in the later stages to absorb the opacities, yellow oxide of mercury ointment are advised.

KERATITIS PARENCHYMATOSA

It is otherwise called interstitial keratitis. It is a cellular infiltration of the middle and posterier layers of the cornea. It is common in children and appears as a rule

between the ages of 6 and 12 years. It is rare after 30. Females are more affected than males. The great majority of cases are due to inherited syphilis. Few cases are due to acquired syphilis. The patient of keratitis parenchymatosa always shows signs of inherited syphilis. Tuberculosis is one of the causes. (Fig. No. 11)

The disease begins either in the centre or at the margin of the cornea. If the disease starts at the middle, it presents a grayish infiltration. The surface is smooth yet without reflex and is dull. The central patch soon spreads and within a short time the whole cornea becomes implicated. Vascularization then begins and the vessels extend into the cornea from various places along the margin of the cornea. They are deep vessels. They are of dirty red colour because they are covered by the clouded layers of the cornea. The vision is reduced to a great extent.

If it commences at the periphery, one or more grayish crescents are seen and spread towards the centre. This variety is more common than the former. The clouding and dullness of the cornea will be less. There will be a mild ciliary injection.

The disease reaches its acme within one or two months and then begins to subside. The periphery of the cornea clears up, the vessels become lessened, the irritative symptoms decrease with a slight improvement in vision. The central patch is the last to clear and may last for 6 months to 1 year in favourable cases.

In some cases the anterior portion of the uveal tract is involved. In mild cases there will be iritis but in severe cases iridocyclitis, choroiditis and changes in the vitreous are apparent.

The most common sequelæ are: posterior synechia, opacities of the vitreous, exclusion of the pupil and staphyloma of the cornea.

The prognosis is unfavourable as far as the duration of the disease is concerned but its ultimate outcome will always be good, provided it is treated early and properly.

Treatment:—General and local. Anti-syphilitic treatment should be started early if the root cause is secondary syphilis. In mild cases general tonics like syrup ferri-Iodide, can be given safely. Mercural Innuctions are also very useful. If keratitis is due to tuberculosis, cod-liver-oil is

very useful. Tuberculine should be tried. Sulphanilimide either orally or in the form of 6% ointment is also tried with better results.

Local:—Atropine, hot compresses, and later on dionine drops and plasma ointment prove useful. Sub-conjunctival saline may also be tried for dissolving the opacities.

OPACITIES OF THE CORNEA

They are characterized by lack of transparency of the cornea as a result of inflammation, ulceration or injury. There are various grades of opacity, nebula, macula, and leucoma. These are well seen with the aid of an oblique illumination or in broad daylight. Nebula is a thin opacity which is often overlooked by the Doctor. Only the epithelial layer is involved. Light is easily transmitted through it. Macula is similar to nebula, but it is slightly denser. Leucoma is the densest and white and is well seen. Depression or facet formation is seen in cases of leucoma. When the iris is adherent to the leucoma the condition is known as adherent leucoma. Adherent leucoma, if not treated properly, may lead to secondary glaucoma and endophthalmitis. (Fig. No. 9)

Treatment:—During the early stages and in slight cases, dionine and plasma ointment proved useful. But when there is thick scar formation, it will be of no use. For clearing up old opacities and specially in keratitis-parenchymatosa, application of electric current is very useful. The positive pole of the battery with a constant current is placed on the forehead, while th negative pole consisting of solid silver cylinder of 7 m.m. diameter, insulated by a coating of rubber, is placed on the eye which is previously cocainized. The strength of the current should be low.

The Optical Aids:—Correction with ordinary lenses, stenoscopic glasses in limited cases and contact glasses when there is an irregular astigmatism, are recommended.

Diseases of the Cornea and their Treatment:—Susruta's classification of keratitis (sukra)—not unlike the modern ophthalmologist, Susruta classifies keratitis on the clinical basis, namely,—1. Keratitis suppurativa or ulcerosa (savrana-sukra) and 2. Keratitis non-ulcerosa (avrana-sukra)—Susruta defines savrana-sukra as a puncture like depression, an abraised spot on the region of the cornea, giving a sensation as if the parts have been pricked with a needle and attended with excruciating pain and hot exudation.

Avrana-sukra (non-ulcerative or plastic keratitis) is defined as a whitish abrasion on the cornea, like a speck of translucent cloud in the sky, attended with lacrimation and slight pain and due to abhisyanda (ophthalmia).

Susruta further subdivides the keratitis according to the location of the inflammatory focus, as

i. involving the superficial layer (eka-twaggatam)

ii. involving the second layer (dwi-twaggatam)

iii. involving the deeper layer (gambhira jatam)

In connection with prognosis of sukra, Susruta taught that if the corneal ulcer is superficial and simple in character, the inflammatory process being generally circumscribed it is cleared up uneventfully. Again when the ulcer is not situated in the vicinity of the papillary region (the centre of the cornea) and does not extend deeper than the superficial layers and not accompanied by intolerable and pricking pain and hot exudation, the prognosis is favourable. If, on the other hand, the second layer of the cornea is invaded and destroyed by the inflammatory process, the prognosis is bad; when the entire region of the cornea is ulcerated, with the accompaniment of acute intolerable pain, the condition is known as Aksipakatyaya (hypopyon), which is according to Susrutian teachings, either incurable or difficult of cure. The prognosis of Avrana-sukra (non-suppurative keratitis) which is chronic in nature and accompanied by thickening of the cornea is not favourable, as it may be cured only with the greatest difficulty. Cure is also difficult when the disease is of long duration and the cornea is mobile, being covered with shreds of highly vascularised conjunctival tissue, which stretch down to the second layer, and obstruct vision. Susruta also describes karkasa sukra (Sclerosing keratitis), Uttana sukra (raised superficial keratitis), etc.

As regards the etiology, Susruta incriminates abhisyanda (ophthalmia) as the most common and important factor for the causation of keratitis in general. Besides this trauma, exposure of the eye to smoke and dust, excessive weeping and over indulgence in grief resulting in disturbances in the nutrition of the cornea are exciting causes.

Treatment:—Local treatment consists of warm medicated compresses, venesection is severe cases, antiseptic and antiphlogistic lotions, cauterisation and application of anjanas (ointments).

No. 9

Corneal opacity

No. 10

Circum-Corneal injection

In non-ulcerative types of keratitis (avrana-sukra) attended with vascularisation of the cornea, Susruta advocated application of lekhya anjana (scarifying ointment) which, besides producing a healing effect on the cornea, exercising a devascularising action on the corneal vessels. In this connection, it would be instructive to observe that Susruta was the first Surgeon-Ophthalmologist to concei ve of the deleterious action of vascularisation over the cornea.

Composition of the lekhya anjana—All kinds of powdered metals (gold, silver lead, copper, iron) metallic substances (realgar, redochre, etc.) salts such as sodium chloride, all kinds of gems (lapis lazuli, coral, ruby, etc.) the teeth of cows, horses, etc., the horns of cows and horses, kasisa (ferrous sulphate), powdered shells of hen's eggs, garlic, trikatu (red pepper, ginger and black pepper), seeds of karanja (Pongamia glabra) and ela (cardamom)—all these being uniformly pounded and pasted together make the scarifying ointment.

In a case of sukra, the affected part should be rubbed lightly with a compound consisting of sirisa seeds (Acacia lebbec), maricha (Piper nigrum), pippali (Piper longum), saindhava pounded together or with saindhava alone.

A compound composed of powders of copper, conch-shell, realgar, piper nigrum and sodium chloride, each preceding drug being taken in a quantity double the one immediately succeeding it in order of enumeration should be pounded together, made into a thin paste applied as an anjana to the area of the ulcer.

The ksara-anjana (caustic ointment) may also be profitably used with an iron applicator. A good quantity of blue barley with horns should be soaked for a week or two in the milk of a black cow and then dried and then burnt to ashes. These ashes are to be intermixed with an equal part of burnt ashes of Arjaka (Ocimum gratissimum), kanchana (Bauhinia variegata), kapittha (wood apple), vilwa (Aegle marmelos), nirgundi (Vitex trifolia), and jati flowers (Jasminum grandiflorum) and an alkaline solution should be prepared therewith. Saindhava and tuttha (copper sulphate) and rochana (gallstone Bijoor) should now be added to the above alkaline solution and duly boiled. The compound thus prepared is to be used as an anjana.

Eyesalves made of fried huskless mudga pulse (Phaseolus mungo), powders of conch-shell (samkha) and sugar mixed with honey or of the inner pulp of the stones of

vibhitaka (Terminalia Belirica) pasted with honey should be used constantly in case of sukra.

Young bamboo sprouts, the shell of Semicarpus Anacardium (Aruskara), palm fibres, and cocoanut fibres should be burnt to ashes and an alkaline solution should be prepared therewith. The burnt ashes of elephants' bones should be soaked several times (at least 7) in the above alkaline preparation, which would be dried in the sun and powdered and made into a paste with honey. The application of this preparation tends to remove the whiteness (leucomata, nebula, opacity) in the case of a sukra. It is to be noted that the eye is to be washed with triphala water, after the application of this anjana.

The general treatment in case of diseases of the cornea consists in the administration of emetics and purgatives to free the system from toxin, and to soothe the deranged bodily humours of ingiving tonics, fresh air and nutritious vitaminised foods to the patient.

CORNEAL TATTOOING AND CORNEAL STAINS

It is specially indicated in opacities with facets. By this procedure the opacity is made completely opaque and the influence of facet on visual acuity is much lessened. This is done only by colouring the cornea with Indian ink or with gold chloride.

Optical Iridectomy:—It is useful in dense scars which cover the entire pupil. One must choose a transparent portion of the cornea for making a coloboma. The coloboma should be narrow and short. When the opacity over the cornea is delicate, optical iridectomy will be of no use but the dazzling will be reduced to some extent. Iridectomy is essential when there is anterior synechia so as to avoid secondary glaucoma. In this case a broad coloboma should be made.

INJURIES OF THE CORNEA

Foreign Bodies:—They generally consist of iron, coal, ashes, dust, etc. They frequently adhere to the cornea. In some cases the foreign body remains as it is and in some cases chemical changes take place with the surrounding tissues resulting in inflammation and ulceration.

Due to the presence of foreign body in the cornea, irritative symptoms like pain, lacrymation and photophobia will develop.

DISEASES OF THE SCLERA

INFLAMMATION OF THE SCLERA—(Scleritis)

It is either superficial or deep. The superficial form involves the episcleral tissue and is known as episcleritis. The deep form, which involves the sclera proper, is known as scleritis.

Episcleritis:—It is characterised by a circumscribed inflammatory node. either nearer or far off from the limbus and it is seen under the conjunctiva.

It is common in old people and specially in those who have got rheumatic or gouty tendency. It is always bilateral. Syphilis, and tuberculosis may give rise to this disease.

Signs and Symptoms:—Inflammatory nodes are present generally on either side of the limbus under the conjunctiva. The colour of the node is purple. They do not suppurate or ulcerate. They are permeated by a violet deeply placed (episcleral) vessels and it is immovably fixed to the sclera. The conjunctiva over it is freely movable. The node feels hard at times and is very tender to touch. The rest of the cornea is free from injection.

The Common Symptoms are:—Lacrymation, slight pain and photophobia. After a few days, the inflammation begins to regress, the node gradually flattens, becomes pale and finally disappears leaving without any trace. But sometimes at the site of inflammation a scar remains and the conjunctiva is firmly adherent to the sclera.

The disease often recurs and so it is often prolonged for months. The recurrence may be at short intervals or at distant intervals. Before the 1st node scarcely disappears a fresh node appears and in severe cases multiple nodes appear and cover the whole surface.

The prognosis is unfavourable with respect to the duration but the vision will not be affected.

Treatment:—It is not very satisfactory. One can reduce the trouble and prevent recurrences by giving internally soda, salicylas, aspirine, diuritic drugs and Pot. Iodide. Locally, atropine and dionine and warm applications in the early stages and yellow salve in the later stages do good. Subconjunctival injection of salt or bichloride of mercury (1 in 5000) may be recommended. If there is great pain and congestion, leeches may be applied to the temple. In resistent cases, mild galvanic current is applied to the nodes with best results.

6

DEEP FORM OF SCLERITIS

It is a deep inflammation of the sclera. It is common in children. Secondary syphilis, scrofula and tuberculosis often associate themselves with the disease. It is more common in females.

The characteristic signs are :—The sclera will be oedematus either partly or wholly and injected. The affected area is dusky or violet in colour.

Severe pain radiating towards the neighbouring parts, tenderness over the ciliary region, lacrymation, and photophobia are present. Tension is increased. Secondary glaucoma often ensues.

The complications are:—Iritis, cyclitis, choroiditis, opacities of the vitreous, secondary glaucoma, ciliary staphyloma or general staphyloma and myopia.

Anterior synechia, posterior synechia and sclerosing keratitis are the common sequelæ.

The course is very chronic and the prognosis is grave.

Treatment :—General. Secondary syphilis, scrofula and tuberculosis should be treated at first. Iodides in the form of Pot. Iodide, Syrup ferri Iodide and mineral waters containing iodine should be given. If there is a disturbance of menstruation iron tonics can also be given internally.

Locally :—If there is inflammation of the iris or ciliary body, atropine, dionine, rest to the eye and hot fomentations are advised. Iridectomy is necessary to prevent secondary glaucoma and for optical reasons. This should be done only after the inflammatory symptoms subside.

INJURIES OF THE SCLERA

The most common injuries are ruptures and perforating wounds due to blows by a blunt instrument.

Treatment :—Small, clean perforating wounds heal by themselves. The wound is kept aseptic and bandaged daily. If there is a wide gap and if there is threatened prolapse of the ciliary body and the contents of the globe, suturing the sclera along with the conjunctiva is very useful. But it should not be sutured when there is any suspicion of sepsis. If there is prolapse of

the iris it should be cut or replaced and the wound is to be dressed regularly. If there is an extensive injury, the eyeball should be removed so to avoid sympathetic ophthalmia of the other eye.

THE ECTASIAS OF THE EYEBALL

Distension of the wall of the eye is known as ectasia. Ectasia may affect the whole eyeball in cases of total ectasia, buphthalmus and hydrophthalmus, or only a portion of it in staphyloma, keratoconus, staphyloma posterior, staphyloma ciliaræ, etc. It is due to increase of the pressure in the eyeball or due to a decrease of the resistance of the wall as a result of inflammation, atrophy and thinness of the sclera.

All the ectasias increase the volume of the eyeball. The enlarged eyeball interferes with the winking, especially when the ectasia involves the cornea, and thereby becomes irritated and inflamed. In many cases closure of the lids is impossible. Xerosis and ulceration may arise owing to the constant exposure of the eye.

STAPHYLOMA CORNEA

Secondary ectasias in the territory of the cornea develop out of perforating ulcers. It may be either partial or total. In partial staphyloma, only a portion of the iris becomes fixed to the scar, whereas in staphyloma totale, the whole region of the cornea is occupied by the iris bulging. The intraocular pressure is not increased and the bulging is only due to the prolapse of the iris in case of partial staphyloma, whereas in staphyloma totale the pressure is increased. Due to the increase of pressure, the optic nerve, the retina and the choroid become atrophied and thereby the eye becomes blind.

Treatment :—Iridectomy should be performed for reducing the tension and thereby preventing the protrusion and progress. For optical purposes a clear cornea should be selected for doing an iridectomy. If there is no anterior chamber, this operation is impossible on account of the risk of injuring the lens.

STAPHYLOMA OF THE SCLERA

It may be either anterior, equatorial or posterior.

Anterior Staphyloma :—It is secondary to the inflammation of the uveal tract and affection of the sclera with

or without an increase in the tension of the eyeball. The bulging is bluish gray and either it is limited or it may extend all round the cornea. In course of years the bulging increases and sometimes even bursts.

Treatment :—It is not satisfactory. Iridectomy or Elliott's trephining is the only resort to arrest the progress of the disease. If the bulging is very big and if there is no vision, removal of the eye ball is advised.

DISEASES OF THE SCLERA (Ancient)

Susruta describes 11 diseases of the Suklamandala (sclerotic circle), of which the five different varieties of Armans (pterygia) have already been described under the diseases of the conjunctiva.

The other diseases of the sclera are the following namely :—1. Suktika (pinguecula) characterised by raised dark brown specks on the white coat of the eye, resembling flesh in colour or having the colour of an oyster-shell.

2. Arjuna (a bloodred raised speck on the sclera). The appearance of a single dot or speck on the sclerotic coat, coloured like a drop of hare's blood is called arjuna.

3. Pistaka (a grayishlooking fleshy spot on the sclera). A raised and circular dot or fleshy patch on the white coat of the eye, coloured dullwhite like rice-paste is called pistaka.

4. Sira-jala (vascularisation on the sclera, Scleritis). A net work of extensive redpatched of hardened vessels ramifying over the white coat of the eye is called Sirajala.

5. Siraja-pidaka (phlyctenule covered with vascularisation) characterised by a crop of white papular growths on the sclerotic coat near the limbus, covered with shreds of vascularisation.

6. Balasa (a speck of the colour of bell metal covered by vessels) characterised by a shining grayish white speck on the sclera near the limbus covered over with vascularisation.

Treatment :—Of the above eye diseases occurring on the sclera, Sira-jala and Siraja pidaka are to be treated surgically by chhedana (excision) operation, while Arjuna, Suktika and Balasa are to be treated by medicinal applications.

In the treatment of Sira-jala, in which the vessels become hardened and sclerosed. the surgeon would secure them with the vadisa jantra (sharp hook) and then carefully excise them with the mandalagra sastra.

For the surgical treatment of Siraja-pidaka in which there are phlyctenules interlaced with vessels, the surgeon would excise the vessels with the mandalogia as in the case of arman.

For the treatment of Arjuna, the surgeon would adopt the necessary measures described before in connection with pittaja abhisyanda. Eyewashes and ointments prepared from the following medicaments, namely, juice of sugarcane. honey, sugar, breastmilk, daru-haridra (Berberies asiatica). yastimadhu (glycerrhiza) and saindhava are very useful in this therapy. Eyelotions such as that of fermanted acid gruel are beneficial.

The following drugs such as sugar, glycerrhiza, syona (Bignonia indica), amla (fermented acid gruel), honey, saindhava, Jambira (citrus acid). Bijapuraka (citrus limmeta). Dadima (Punic granatum) of acid taste and other acid fruits either singly or in combination of two or three should be judiciously used as an aschyotana (eyelotion) in case of Arjuna.

The following anjanas are to be profitably used in the case of arjuna:—Sphatika (crystal), powdered samkha (conch shell), glycerrhiza and honey all these pasted together. Powdered samkha, honey, sugar and samudra-phena (Sepia-officinalis) all these made into an ointment or an ointment prepared by pasting rasanjana (extract of Berberis asiatica) with honey; or one made by pasting kasisa (ferrous sulphate) with honey.

In obstinate cases, however, Susruta advises the surgeon to make use of lekhya anjana (scarifying ointment) the composition of which has already been described under the treatment of sukra (keratitis).

Treatment of Balasa—In this disease after venesection the surgeon would apply ksara—anjana (caustic ointment) already described in connection with the treatment of sukra.

For the treatment of the eyedisease known as Pistaka (a grayish looking fleshy spot on the sclera) an anjana prepared from a compound of sunthi (dry ginger), pippali (Piper longum), Musta (Cyprus rotundus), saindhava and Sitamaricha (white pepper) all these pounded in equal parts and

pasted with the expressed juice of lemon (citrus acid) would bring about a speedy cure when properly applied.

For the disease known as Suktika (pinguecula) the following ointment is useful—Vaidurya (lapis lazuli), sphatika (crystal), pearl, ruby, conchshell, silver and gold—all these finely powdered in equal parts and made into a paste with sugar and honey would be most efficaciously applied in suktika.

DISEASES OF THE UVEA

Inflammations of the uvea can be classified under 1. Iritis, 2. Iridocyclitis, 3. Uveitis, 4. Sympathetic ophthalmia, 5. Choroiditis, and 6. Panophthalmitis.

Iritis :—It is an inflammation of the iris. It may be primary or secondary. The most common causes are the following :—1. Traumatic, 2. Sympathetic, 3. Diabetis, Syphilis, Rheumatism, Tuberculosis, Scrofula, Gonorrhoea, 4. Infectious diseases and 5. Septic teeth.

The most prominent symptoms are pain, lacrymation, photophobia, and ciliary injection. The pain is terrible and the patient feels restless during the pain. The pain radiates forwards towards the head and the temple. Pain will be aggravated by light, by frequent examinations, cold waves and gets worse during nights. The acuteness of vision will be reduced owing to the clouding of the anterior chamber and deposits on the pupil and in the descemets' membrane. Some times the vision may be reduced to mere perception in cases where the deeper parts are affected. Sometimes fever and vomiting may accompany.

There is mild clouding and dullness of the cornea. On careful examination one finds deposits on the descemet's membrane (Keratitis puncta). The anterior chamber is hazy and it contains turbid fluid. The exudation may turn into blood (Hyphaemia) or into pus (Hypopyon). The depth of the anterior chamber may be increased. The iris and the markings of the anterior surface are indistinct. The iris is swollen, lustreless, becomes greenish or muddy in colour and in old cases it becomes atrophied and sclerosed.

The pupil :—It is narrow, irregular, grayish and sluggish to reaction. It may be adherent to the lens (Posterior synechia). There is a defective reaction to atropine. The anterior capsule of the lens may show deposits and may get adherent to the iris. (Fig. No. 23).

The disease may take an acute or chronic course. An acute-one runs its course and resolves within 3 or 4 weeks. while a Chronic case runs for months. Very many cases terminate favourably.

Complications:—Conjunctivitis, Keratitis, cyclitis, optic neuritis, Retinitis.

The most common sequelæ are posterior synechia, Anterior synechia, occlusion and exclusion of the pupil, atrophy of the iris, opacities of the vitreous and cataract.

Seclusio Pupillae:—This condition arises when there is ring form posterior synechia. This cuts off the connection between the anterior and posterior chambers. The aqueous secreted by the ciliary processes cannot go into the anterior chamber. Therefore the posterior chamber begins to distend and push the iris forwards. (Iris Bombe).

Occlusio Pupillae:—It is an optical interference due to dense opacities or membranes filling the entire pupil. The sight is reduced to a great extent. There is no obstruction between the anterior and posterior chambers.

CYCLITIS AND IRIDOCYCLITIS

Cyclitis or inflammation of the ciliary body is very rare and often accompanies iritis. Therefore iridocyclitis which is very common, has got the same etiology, signs and symptoms as that of Iritis except there is (1) Marked circumcorneal injection, (2) Tenderness over the Ciliary body, (3) Conjunctival injection and oedema of the lids, (4) Hypopyon or hymphaemia. (5) Aggravated pain and (6) Reduction of sight. (Fig. No. 8.)

Syphilitic Iridocyclitis:—It is one of the most common forms of iridocyclitis. It is common in adults and less common in youngsters. This disease appears mostly duriag the second stage of the syphilitic infection. Papules appear in the iris at the pupillary zone or at the ciliary border. They are the size of a pin head or even slightly bigger. The colour is red in blue iris and white in brown iris. They do not break. In favourable cases, these nodes get absorbed leaving behind circumscribed atrophy of the iris and further sequelæ. The symptoms are those of iridocyclitis. The common sequelæ are posterior synechia, occlusio and seclusio pupillæ, choroiditis, retinitis and optic neuritis.

Rheumatic Iritis:—It is also common. It appears along with joint and muscular rheumatism. The iritis is very

severe. Acute pain, ciliary injection and photophobia are common. Relapses are also very common. The attack may be brought about by exposure to cold. Complications and sequelæ are less, except in repeated relapsing cases.

Gonorrhoeal Iritis:—It genarally appears along with gonorrhoeal rheumatism. The iritis is typical. Relapses common. The disease is seen mostly in males.

Iridocyclitis Metastatica:—It is due to infectious fevers and sepsis from septic tonsils, teeth, etc. Complications and sequelæ are the following—hypopyon, posterior synechia and in severe cases suppurative endophthalmitis.

Secondary Iridocyclitis:—It arises as a result of ulcer serpens, keratitis and scleritis. It is very severe.

Treatment:—General and local.

Syphilitic Iritis :—Salvarsan, innuctions of mercury and internally small doses of gray powder, liq. Hydragiri perchloride, and Pot. Iodide;

For Rheumatic Iritis, Salicylates, Aspirine, and Diuritics;

For Gonorrhœal iritis, Diaphortics, Diuritics, M & B 693 internally and G. Vaccine injections subcutaneously; and

For Tubercular Iridocyclitis, Tuberculine injections subcutaniously and Cod-liver-oil internally are advised.

In addition to these, rest in bed in acute cases specially in a dark room is highly advised. Smoked glasses are also very useful. The bowels should be regulated daily. Severe pain may be combated by giving Aspirine internally.

Local :—Atropine, and Iridectomy are the most common remedies. Atropine can be dropped any number of times in case of Iritis. When it is associated with cyclitis, Dionine should also be dropped.

Treatment of Uveitis (Chronic Irido-Cyclitis).

A quick diagnosis and early use of Atropine is the sheet anchor in the treatment of Uveitis. If atropine fails calomel followed by saline is tried. Cocain and Adreneline pack helps to dilate more by acting on the sympathetic and para sympathetic nerves.

The causitive factor should be treated. If due to focal sepsis-care of teeth; if due to septic tonsil or inflamed

apendix, they should be removed. If due to gonorrhoea-gonorrhoeal vaccine and sulphanalimide, specially M & B 693 are tried. If due to Tubercle — Tuberculine Treatment is the best.

For an adult, ·1 cc, of 1 in 100,000 dilution of old tuberculine of bovine variety is given. If there is no improvement a second dose is given after 3 days, If still there is no improvement a third dose of ·15 cc. may be tried after 3 days. Generally improvement is seen after the 1st dose.

If the etiology is unknown — protein shock Therapy, Tuberculine. Cal. Gluconate, Insuline, Sub-conjunctival cyanide, Auto-haemo-Therapy may be tried with some benefit.

Cow's Milk. 15 to 20 cc. can be given on alternate days without any shock for 3 times.

Calcium Gluconate. 10 cc. of 10% solution is given every day after protein shock therapy for about 6 to 12 times.
Insuline. 2 units daily for the 1st week and twice a week for about 3 weeks is necessary.

Auto Haemo Therapy. ·1 cc. of blood is injected into the anterior chamber just enough to cover the iris. This is specially found to be useful in Uveitis secondary to Paranchymatous Keratitis of tubercle origin.

Boric fomentation relieves the pain to a very great extent. Blood letting, application of leeches to the temples, and Diaphoritics internally relieve the congestion to a great extent.

Subconjunctival saline is indicated when there is no active inflammation.

Iridectomy is the most important operation against the sequelæ of Iridocyclitis. It is indicated in chronic Iridocyclitis, Seclusio and occlusio pupillæ, and posterior synechia.

SYMPATHETIC OPHTHALMITIS

It is an inflammation of one eye due to effects of a similar inflammation of the other eye. The 1st eye is the exciting eye and the 2nd eye is the sympathizing eye. It generally arises as a result of injury, of the ciliary body or the iris. Supparative inflammation does not generally gives rise to this inflammation. The disease is not very common. Modern surgery with its asepsis has reduced the onset of sympathetic ophthalmia to a very great extent. Sympathetic

ophthalmitis generally arises four weeks after the affection of the excited eye. It may occur even months later. The exciting eye presents a picture of plastic Iridocyclitis. The sympathizing eye shows a similar picture.

Symptoms and course:—It begins with a mild ciliary injection and dullness of the cornea and precipitates over the Descemet's membrane. The symptoms are at first very slight. There is slight disturbance of vision. Later on when the iris and the ciliary body are involved, there will be pain, photophobia and lacrymation. The iris loses its lustre and becomes dull and muddy. The blood vessels on the iris are prominent. The iris becomes adherent to the lens (Posterior synechia). Seclusio pupillæ may be present. Tension is generally decreased. The iris begins to atrophy, the lens gets clouded and finally, complete atrophy of the whole eye ball takes place. The vision is completely lost and the eye is practically blind.

The course of the disease is always progressive but there are always exacerbations and remissions. A few months after the attack, the eye may regain its normal state and remains as normal, or a few years later the inflammation may relapse again and again and finally destructive process sets in with complete blindness.

The prognisis is always unfavourable. Very few cases are being cured. Timely removal of the exciting eye favours the prognosis.

Treatment:—Very few cases go to the hospital at the early stage. If there is plastic iridocyclitis of the exciting eye with irrecoverable loss of sight and remains painful, it should be removed so as to prevent the sympathetic ophthalmia of the other eye. But difficulties arise when the sympathetic ophthalmia has already developed. In such a case, the exciting eye should be removed when there is absolutely no chance of recovery so as to retard the progress of the sympathizing eye. But it should not be interfered with when there is sight, when signs and symptoms are not very severe and when there is a hope of recovery.

Locally Atropine, hot compresses and bandaging will relieve the pain to some extent. Milk injections are being tried nowadays and favourable results are being reported. Mercural inunctions, Diaphoresis of varying sorts may be of some use. Neosalvarsan in small doses is also tried. Tuberculine is found to be useful. Sulphanilamides can be tried with some benefit.

CHOROIDITIS

It is an inflammation of the choroid. It is either primary or secondary. Primary choroiditis generally arises from congenital or acquired syphilis, tuberculosis, scrofula, anaemia, old age, and myopia. Sepsis from teeth, tonsils or from intestine may give rise to choroiditis.

There is absolutely no pain unlike other inflammations. The only trouble that makes the patient seek the advice of the Surgeon is for diminished sight. Some cases may not show any disturbance. Central choroiditis gives rise to complete blindness. The most prominent symptom of choroiditis is gradual deterioration of sight.

Externally, there is no change and nothing can be seen with the naked eye. On an ophthalmoscopic examination, the whole picture is typically seen. Patches of plastic exudation are seen here and there in varying sizes. They are at first yellowish white in colour and later on, they turn into white patches. These patches may undergo pigmentary degeneration. The retina may be involved and shows signs of atrophy. The course is always chronic. Partial or complete blindness takes place in obstinate cases of choroiditis.

Clinical Varieties of Choroiditis:—

(1) Choroiditis centralis—The macular region is affected and the patient is completely blind.

(2) Choroiditis Disseminata —Uniform distribution of the foci all over the fundus. This is a very chronic one. The retina and the optic nerve may be involved, resulting in diminution of sight.

(3) Diffuse choroiditis—In this the patches will be fairly big. They coalesce with each other and leave a big atrophic spot. It may or may not be pigmented.

(4) Syphilitic choroido-Retinitis—It not only involves the choroid but also the retina, the vitreous and rarely the optic nerve.

(5) Choroiditis in Myopia—It is characterized by atrophy of the choroid at the posterior pole of the eye.

Treatment:—General and Local.

Constitutional diseases like syphilis, scrofula, tuberculosis and anaemia should be treated. For syphilis anti-syphilitic treatment should be given.

For Anaemia:—Iron and liver should be given.

For Tuberculosis:—Tuberculine injections, cod liver oil and general tonics should be given. Fresh air, and good food are adopted.

For Myopic Cases:—Near work should be avoided. Rest to the eyes, smoked glasses and out door life should be advised. Suitable—glasses are advised.

Local:—Sub-conjunctival saline, diaphoresis, and rest to the eyes are advised.

PANOPHTHALMITIS

It is characterized by purulent inflammation of the whole uveal tract. It is due to infection either from perforating wounds, or through operations or from pyaemia, puereperal septicemia, meningitis, etc.

The signs and symptoms are acute and severe. Acute ciliary pain, photophobia, lacrymation, chemosis of the conjunctiva and oedema of the lids are present. Later on, pus accumulates in the anterior and posterior chambers. The whole uveal tract undergoes destruction. There may be proptosis owing to the increased amount of exudate. Along with this there are generally constitutional symptoms like fever, headache and vomiting. The sight is completely lost. The prognosis is grave.

Treatment:—Free purgation and salicylates internally will relieve to some extent the pain and constitutional disturbances. Locally to combat pain, atropine and warm compresses may be applied. The pus can be let out under local anaesthesia by an incision. When all the signs of inflammation subside, enucleation is advised.

DISEASES OF THE UVEA (Ancient)

Diseases of the Uvea:—Susruta describes the following diseases, namely, Amladhyusita (iritis); four varieties of adhimantha (uveitis) 1. Vataja adhimantha (due to derangement or disease of the nervous system), 2. Pittaja adhimantha (due to biliary metabolic derangement or constitutional disease), 3. Kaphaja adhimantha (due to lymphatic derangement), and 4. Raktaja adhimantha (due to disease of the blood). Two types of aksipaka (suppuration) of the globe are:—1. sasopha-aksipaka (sympathetic ophthalmia) with swelling and 2. asopha-aksipaka (plastic endophthalmitis).

Susruta defines Amladhyusita (Iritis) as inflammation with chemosis of the iris as well as other adjacent ocular structures, attended with a bluish red tint (ciliary and conjunctival injection) the result of partaking of meals composed of an unduly large proportion of acid food stuffs or of food which causes an acid reaction in the stomach.

The etiology of the four varieties of adhimantha (uveitis) is discussed by Susruta as follows:—

When the four types of abhisyanda (ophthalmia) become chronic without having been properly treated at the outset, they may progress to the stage of adhimantha (uveitis) which is attended with excruciating pain in the eye, which feels as if it were being torn out and as if the pain were extending upward to and crushing as it were, half of the region of the head. The characteristic symptoms and signs of the doshas (humours) involved in each case are also seen to supervene.

Symptoms of vataja adhimantha—the eye becomes cloudy; a sensation is felt as if the eye were torn out and churned, as it were, with an arani (fire-producing-wood): attended with an irritating, piercing and cutting pain, as well as drying and atrophy of the local flesh, and a twisting and crackling sensation in the half of the head on the side of the affected eye. Local swelling, shivering and pain are also present.

Symptoms of kaphaja adhimantha—in the kaphaja type of uveitis, the eye is swollen with slight conjestion, discharges with a sensation of itching; coldness and heaviness in the affected localities and horripilation are marked. The eye becomes slimy with deposits of mucus matter. The sight becomes cloudy, nostrils dilated; severe headache supervenes and all objects are seen full of dust.

Symptoms of raktaja adhimantha—A pricking and shooting pain in the eye attended with a blood-streaked exudation, the organ looking bright red like a bandhujiva flower (Pentapetes phoenicia) are the symptoms which are characteristic of raktaja adhimantha. The eye becomes intolerably painful and incapable of bearing the least contact; all objects seem to be enveloped in flames. There is redness in the extremities of the eye, and the whole of the Krishna mandala (black portion of the eye) looks like an arista fruit (Melia azadirachta) submerged in blood.

Susruta discusses the Prognosis of the four types of adhimantha as follows:—A course of injudicious diet and intemperate conduct or medical treatment may bring in loss of vision within seven days from the onset of the kaphaja type of the uveitis; within a period of five days from the onset of the raktaja type; within six days from the onset of the vataja type, and within three days from the onset of the pittaja type.

Symptoms of sasopha aksipaka:—A case of sasopha aksipaka (sympathetic ophthalmia with swelling) exhibits the following symptoms :—Itching sensation, deposit of mucus in the eye, lachrymation and ciliary injection of the eye, which assumes the colour of a ripe udumbara fruit (Ficus glomerata), there is a burning sensation in the eyeball, which becomes copper coloured and heavy, attended with pricking pain and horripilation; there is chemosis of the eye, constant exudation of either cold or hot slimy discharges, all these leading on ultimately to suppuration. All the above symptoms and signs except swelling mark a case of asopha-aksipaka (plastic endophthalmitis).

The treatment discussed under the various forms of abhisyanda (ophthalmia) is also applicable to the four forms of adhimantha (uveitis) and iritis in general. The treatment of sasopha and asopha-aksipaka is briefly outlined below:—

After having cleansed the system internally and externally by emetics and purgatives and application of sneha (oleaginous medicaments) the surgeon would soothe the eye with sveda (compresses) and then resort to venesection. After this antiseptic and antiphlogistic eyewashes, eyedrops and aksipurana (filling the socket with medicated lotions) errhiaes and applications of ointments should be employed.

Anjana-saindhava and clarified butter (ghrta) pasted together in a copper vessel and applied as an anjana, as an alterative, the rust of bell-metal pasted with clarified butter or saindhava pasted with breast-milk or equal parts of pith of Madhuka tree (Basia latifolia) and red ochre (swarna gairika) pasted together with honey, or saindhava and pulverised copper pasted together with breastmilk and clarified butter should be profitably employed as anjana in both types of Aksipakas.

DISEASES OF THE RETINA

RETINITIS:— (Inflammation of the Retina).

Retinitis is either primary or secondary. It is of various types. Generally the inflammation extends into the papilla as

well as to the choroid. The disease is generally confined to one eye but if it arises as a result of constitutional diseases, it affects both the eyes. It runs always a chronic course and is rarely acute. It is due to either local causes such as injury or general causes such as Nephritis, Diabetis, Syphilis, Tuberculosis, and Auto-intoxication. It may be due to the extension of the inflammation from the iris, the ciliary body or the choroid.

There is disturbance of vision with the diminution in the acuteness of vision. There are changes in the field of vision, alteration in the shape of objects big or small and the diminution in the light sense. Photophobia and slight discomfort in the eye also set in. These vary according to the severity of the affection of the Retina.

Ophthalmoscopic Picture:—It is very characteristic. Hyperaemia of the retinal vessel system is noticed. The retina is red and oedematus. The veins become tortuous and corkscrew like. The papilla is more markedly reddened, the excavation disappears almost entirely. The margins of the papilla become indistinct and the papilla becomes as red as the fundus. Some times the papilla escapes affection. Exudation of varying sizes and shapes is found along the line of the Retinal vessels and at the macula. Haemorrhages may accur, either superficially or deeply. The exudation gets less as it approaches the periphery. The vessels which are tortuous and distended, are generally obscured by swelling and exudation. In cases of simple retinitis, the inflammation limits itself only to the superficial layers and so redness and inflammation are the only signs that are present.

Course:—The inflammation may subside, the exudation may get absorbed and the patient regains his vision. In some cases considerable impairment of vision is noticed when there is atrophy of the retina or the optic disk, and complete loss of vision occurs when the macular region is destroyed.

Treatment:—Local and General.

Local:—Atropine, Absolute rest to the eye, protection from light by wearing smoked glasses, form the best local treatment.

Pot. Iodide, Mercury, Diaphoretics may be given in large quantities. The various constitutional diseases should be attended to, side by side with the above treatment.

ALBUMINURIC RETINITIS

It occurs mostly in chronic interstitial Nephritis. It occurs in Albuminuria of pregnancy. It is common in adults. It is of prognostic importance.

The ophthlmoscopic picture of it is quite characteristrc. It appears in two forms.

(1) Neuro-retinitis with numerous large white foci are seen on the retina about the papilla. These white foci may join each other forming a big patch which includes even the macula.

(2) There is no hyperaemia and the papilla is pale. Borders are distinct. White star-figure exudates are seen in the macular region. Very rarely blood extravasates, neuritis and circulatory disturbances occur along with the tronble. (Fig. 19)

DIABETIC RETINITIS

It occurs in diabetis mellitus and specially in old people. Males are more affected than females. It is bilateral. It is characterized by the following typical picture. The papilla is sharply limited, and there is no hyperaemia. There are numerous tiny flecks in the macular region formed into a star-like figure with extravasates of blood here and there. The symptoms are the same as those of Albuminuric retinitis. The case is very chronic. In rare cases lipaemia occurs as the last stage. (Fig. 14).

SYPHILITIC RETINITIS

It is very common and generally arises in the acquired variety The neighbouring choroid and the iris may also be affected. It is of three types, (1) Diffuse, (2) Circumscribed and (3) Central recurring Retinitis.

Diffuse Retinitis Syphilitica:—It is characterized by diffuse clouding of the Retina by presenting more and more white flecks here and there on the whole retina. There is hyperaemia of the papilla and its borders. They are more or less obscured. In the later stages there may be pigmentary degeneration of the Retina as well as atrophy of the choroid. The vitreous presents dust-like clouding. The whole inner picture is being obscured owing to the clouding of the vitreous.

Circumscribed Retinitis and Central Recurring Retinitis are very rare.

No. 19

Albuminuric Retinitis

Note the white spots in the form of Stellate figure, chiefly at the Macula and surrounding the disc

No. 20

Blepharitis

Note the glueing of the eye lashes and and ulceration of the lid margin

EMBOLISM OF THE CENTRAL ARTERY

It may be due to valvular disease, Atheroma, Aneurism, Bright's disease and pregnancy.

The condition is very rare. But when once it comes it causes sudden blindness without any pain. It is generally unilateral. The left eye is most commonly affected.

The Ophthalmoscopic Picture:—The fundus becomes pale and oedematus, within a few hours after the attack. This picture is well seen near the macula and the disc and it gradually fades away towards the periphery. In the macular region there is a bright red spot on grayish white retina due to the red colour of the choroid seen through the thin retina opposite this area. The arteries are very thin and gradually fade away towards the periphery. The veins also contain less blood. Pressure upon the eyeball produces the appearance of broken columns of blood in the arteries with clear spaces between them.

There is complete blindness within a short period. Perception of light is also lost. Very rarely good central vision is preserved by the patency of some of the macular branches, given off by the central artery behind the embolus.

The final results of Embolism are the following:—The retina and the disc begin to atrophy and the blood vessels get completely shrunken and reduced to white lines.

Prognosis:—It is grave.

Treatment:—It is not successful. Parcentesis of the cornea and then masage of the eyeball may be done to drive out the embolus into one of the smaller branches so as to avoid complete blindness. Amyl-Nitrate inhalations may be tried in some cases.

Thrombosis of the Central Artery arises under similar conditions and it is difficult to differentiate it from Embolism.

THROMBOSIS OF THE CENTRAL VEIN

It is due to the cardiac disease with atheroma. It also follows cellulitis of the orbit. The veins are greatly engorged and tortuous. There will be numerous haemorrhages along the course of the vessels. It gives a typical picture of Retinitis Haemorrhagica.

Treatment:—The cause is to be treated. Ergot and calcium may be given internally.

RETINITIS PIGMENTOSA

It is otherwise known as pigmentary degeneration of the retina. It is characterized by atrophy of the retina with migration of pigment from the pigment epithelium into the inner layers of the retina.

The disease always affects both the eyes. The hereditory factor plays a great part. Hare lip, Deafness and other congenital anomalies may accompany the disease.

The disease at first starts as night blindness depending upon the extension of the field vision. The central vision will always be perfect but the peripheral vision will be affected. With feeble vision the peripheral parts do not react to light and on this account the patient cannot find his way about at night. As age advances the field becomes contracted even with good illumination. Finally the central vision is lost ending in complete blindness.

Ophthalmoscopic Picture:—It is very characteristic. Pigmented flecks of star-shaped or bony-corpuscle like are distributed along the periphery of the fundus and along the blood vessels. They are black in colour. As the disease advances, these flecks begin to increase in number and approach the disc. The colouring matter begins to migrate and expose the choroidal vessels. The retinal vessels get narrowed and finally disappear, the disc and the retina also get atrophied and the papilla takes a gray yellowish colour.

The course is always progressive and nothing can stop the progress of the disease.

Prognosis:—It is unfavourable.

Treatmnt:—It is not satisfactory. Sub-conjunctival saline and gland extracts may be given. Liver therapy, vitamin A by mouth or by injection, cod-liver-oil is now tried with some what better results.

DETACHMENT OF THE RETINA

The term means separation of the Retina from the choroid either by serous exudation, sub-retinal Haemorrhages or tumors, etc. The most frequent detachment of the Retina is the serous one. This detachment occurs mostly in cases of myopic eyes and less in old and non-myopic eyes. The detachment is also commonly seen in sudden evacuation of the vitreous either due to perforating injuries or after cataract

No. 15
Retinal Detachment

No. 16
Glaucomatous Cup around the disc

extraction. Violent Trauma, *i.e.*, concussion of the eyeball may cause the detachment without any loss of the vitreous.

There is complete loss of vision in that part of the field which is opposite to the detachment. Since there is a clouding of the vitreous, the vision will be blurred. Early symptoms are metamarphopsia and flashes of light. As long as the macula is not affected the central vision will be perfect.

Prognosis :—It is very serious.

Treatment :—Surgical.

OPTIC NEURITIS

It is an inflammation of the optic nerve and it is due to the following causes:—(1) Brain diseases, (2) Diseases of the spinal cord. (3) Syphilis—4th stage, (4) Acute febrile diseases, (5) Chronic diseases of metabolism-Albuminuria, Diabetis, (6) Acute anaemias, (7) Poisoning by Lead, Alcohal, Idoform, and (8) Heredity.

Prognosis and Treatment :—Not satisfactory.

DISEASES OF THE RETINA (Ancient)

Susruta describes the following varieties of Timira or Linganasa (Retinitis), namely:—

1. Vataja Timira (of neural origin)
2. Pittaja Timira (due to metabolic or biliary disorder)
3. Kaphaja Timira (due to derangement of the lymph)
4. Raktaja Timira (due to diseases of the blood)
5. Tridoshaja Timira (due to the derangement of the three humours of the body.

Specific characteristic symptoms in the different types of Timira are:—In the vataja type of Timira the vision is blurred and reddish coloured, in the kaphaja variety, white coloured, in the raktaja bright red coloured, in the pittaja variety yellow coloured, while in the Tridoshaja timira the vision is blurred and of variegated colours.

The general principles of therapy to be adopted in the case of timira are given below:— The patient should be kept constantly purged by administering draughts of matured clarified butter cooked with the admixture of suitable purgatives.

In the vataja type purging should be done with a suitable dose of castor oil taken through the vehicle of Milk. Administration of traiphala ghrta (clarified butter) cooked with the decoction of triphala is also recommended for purgative purposes especially in Raktaja and Pittaja types. Clarified butter cooked with Trivrit (Ipomoea Turpethum) should be given to a patient afflicted with Kaphaja Timira in order to induce free purgation, while oil duly cooked with Trivrit should be given internally for purging in a case of Tridoshaja Timira. The use in any shape. i. e. as draught, snuff (nasya), abhyanjana (external appilcation) of old and matured clarified butter kept in iron vessel proves beneficial in cases of Timira of any type. Clarified butter cooked with the decoction of Meshasringi (Gymnema sylvestre) always proves beneficial in a case of Kaphaja Timira.

A patient suffering from Kaphaja Timira should regularly take powdered Triphala mixed with clarified butter. This is also to be given in the pittaja and raktaja types. In vataja Timira, the patient should take triphala powder mixed with til oil (Sesamum Indicum) while in Kaphaja type, the patient should be given triphala powder with a sufficient quantity of honey.

The use of Nasya (snuff). Oil cooked with the decoction of cow-dung would be beneficially used as snuff in all types of Timira. The use of ghrta alone as snuff is useful in pittaja type.

Anjana inpittaja Timira-rasanjana (extract of Berberis asiatica) honey, sugar, manahsila (realgar) and yastimadhu (glycerrhiza) all these compounded together and made into an anjana.

Anjana in Vataja Timira—The fat of vulture (grudhra), black snake and cock and yastimadhu pasted together with honey would be applied as an ointment.

The following anjana is useful in Kaphaja Timira— Manahsila, trikatu (red pepper, ginger, and black pepper), Samkha, honey, saindhava, kasisa (ferrous sulphate), and rasanjana—all these being chemically compounded together and made into an anjana.

The anjana described in connection with Pittaja Timira is also useful in Raktaja Timira.

Diet therapy in Timira—A person regularly and carefully partaking of old and mature clarified butter, triphala, Satavari (Asparagus Racemosus), Patala (Trichosanthes dioica), mudga (Phaseolus mungo), Amalaki (Embelica officinalis) and barley in his dietary enjoys immunity from all attacks of dreadful Timira. Simply a payasa (porridge) prepared from Satavari, milk, and rice or one prepared by boiling milk with Amalaki or a meal of barley corns cooked with the decoction of triphala and a copious quantity of ghrta would be useful in warding off attacks of timira. The use of the following vegetable edibles such as Jivanti (Celtis Orientalis), Sunisannaka (Blepharis edulis), Tanduliyaka (Amarantus spinosus), Mulaka (Raphanus Sativus) as well as the meat of birds such as lava of wild animals such as deer, etc. should be considered as very invigorating to the eyesight.

Susruta also described Hatadhimanha (Atrophy of the optic nerve). This is characterised by the incarceration of the deranged Vayu (nervous force) in the optic nerve, with impairment of vision. This disease is incurable.

Hrasva-jadya (Retro bulbar neuritis chronic)—characterised by gradual diminution in the acuteness of vision. Small things can be viewed only with the greatest difficulty even in the daytime, but can be viewed easily and clearly in the night owing to the soothing of the deranged pitta (the biliary humour) through the coolness of the atmosphere. The disease is difficult of cure. In these cases, palliative treatment, as outlined in vataja abhisyanda and retinitis would be adopted.

DISEASES OF THE LENS

Susruta was the first ophthalmic surgeon to have understood the anatomy, physiology and functional importance of the lens, and to have studied the pathogenesis of cataract. To Susruta goes the glory of having been the first ophthalmic surgeon to invent and perform the classical cataract operation. Indeed Susruta, the world's first surgeon, is the founder of cataract surgery.

Ophthalmic surgery made a great advancement in the prehistoric Susrutian age and we owe it to Susruta for having described the anatomy of the lens. Susruta knew fully well the functional importance of the lens. For it was he who first described its true location and who knew that the lens only served to focus the light rays upon the retina.

Susruta described the macroscopic anatomy of the lens as a biconvex body simulating a Masurpulse (lentil, lens esculenta) in shape and size.

Susruta studied the pathology of cataract and recognised that cataract was an opacification of the lens and that it was due to the derangement of intraocular and bodily lymph, (Sleismika linganasa).

Susruta recognises the following varieties of cataract namely:—(1) cataract with a semilunar nucleus (2) cataract of the colour of a sweat drop (3) pearl-shaped cataract (4) hard cataract (5) irregular cataract (6) cataract with a thin nucleus (7) striate cataract (8) multicoloured cataract (9) bloodred coloured cataract. He also describes congenital cataract.

The treatment of cataract (Sleismika linganasa) according to Susruta, is by means of operation. He advocates the operative treatment of mature cataractous lens. He forbids the operation of unripe cataracts.

Susruta's technique of lens couching method of cataract operation by anterior route is briefly described below.

Time of the operation—the operation of lens couching is to be performed in a season which is neither very hot nor very cold.

Preoperative treatment—the surgeon should see that on the day previous to the operation the patient is duly purged by emulsive measures and purgatives, thus freeing the system from the derangement of bodily humours. He should be rid of any constitutional diseases as far as possible, such as bronchitis, pharyngitis, rhinitis, conjunctivitis, diabetes etc., before being brought to the operation table. He is to be given a non-stimulating diet. On the day of the operation the patient should be scrupulously advised to possess a cool temper and an unperturbed and cheerful mind.

Technique of the operation—the patient should be seated on a specially designed and constructed operation table and should be asked to look equably and uniformly towards his nose and should keep his eyes steady without moving them in any direction.

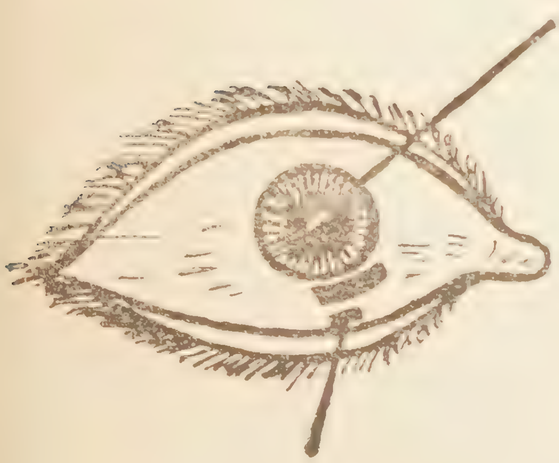
The surgeon should then open the eye sufficiently and keep the lids stretched by an assistant.

The point of puncture on the globe should be just outside the junction of black and white regions (Limbus,)

in a line dividing the white portion equally into two segments upper and lower and should not be over the plexus of blood vessels. It should be in the line of the natural aperture (Daiba Kritachhidra) of the eye.

The surgeon should hold the Jabamukhi salaka (the curved barley-mouthed needle) in the middle carefully, steadily and confidently by the thumb, forefinger, and middle finger and should puncture through the natural aperture of the eye, neither above, nor below, nor laterally the left eye with the right hand, and the right eye with the left hand. A right puncture will be indicated by the exudation of a drop of water and a sound, while an incorrect puncture will be followed by bleeding. Immediately after the puncture is made, breastmilk should be sprinkled over the operated eye. Then keeping the eye fixed light fomentation (sveda) externally to the eye should be applied. The cataract, after being reached through the natural aperture, should be scribbled and scarified with the tip of the salaka, till it is dislodged out of the visual field. The patient's nose will now be closed and he will be asked to sneeze and suck in phlegm from his nasal sinuses into his throat. The proper dislodgement of the cataractous lens will be heralded by the clearance of vision, as the sun becomes brilliant after the clearance of clouds and the eye will be painless.

1st Step of Couching



No. 24

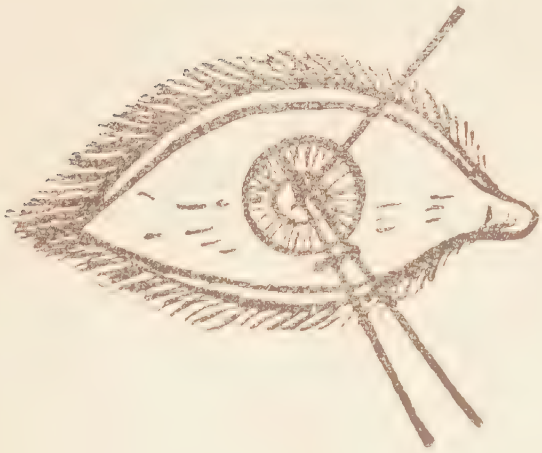
Apuncture is made in the Sclerpo - cornea below with a lancet

2nd Step of Couching

No. 25

The instrument is inserted through the puncture made in the anterior Chamber

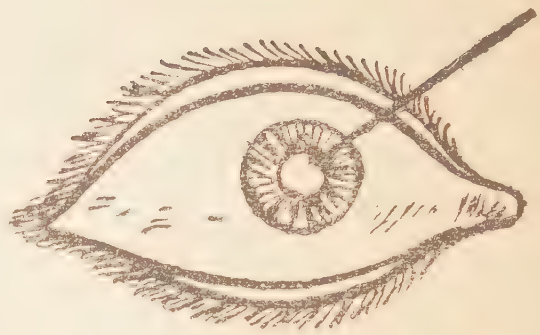
3rd Step of Couching



No. 26

The lens is dislocated by pushing it down

4th Step of Couching



No. 27

After the dislocation of the Lens by the Surgeon

After this the surgeon should withdraw the barley mouthed salaka carefully and gently. Lukewarm clarified butter should be poured into the eye, a lint soaked in the same is put over it and the eyes will be bandaged properly.

Post-operative treatment—the patient is to be laid flat in a chamber which would be free from dust, smoke, well protected from the Sun's rays and with free ventilation. The patient should remain calm and quiet. The patient should be asked not to eructate, nor yawn, nor cough, nor sneeze, nor spit.

On the third day, the surgeon should open the eye and wash it with decoction of drugs possessing soothing, anti-phlogistic and antiseptic properties; i.e., root of Ricinus communis and Embelica officinalis etc, and bandage it up with a fresh bandage. After the fourth day, the surgeon should begin giving compresses regularly.

On no account should solid food be given to the patient He should be given only liquid light food and vitaminous food stuffs and enough of fresh milk for ten days, after which he should be given light solid articles in moderate quantities followed by enough of milk.

If all goes on well, the surgeon should remove the bandages on the 10th day and the following restriction should be imposed upon the patient, that is he should be asked to restrain from looking at dazzling light and glazing sun till the accommodation of the eye is restored to its normal state.

Susruta gives the contraindications for operation as follows and also describes the symptoms, signs and treatment of the disorders and complications resulting from injudicious or faulty operation.

Lens couching operation is forbidden in the following cases:—Boys and old men who suffer from a haemorrhagic diathesis, and therefore unfit for venesection, people suffering from acute bronchitis and pharyngitis and pregnant woman.

Susruta also wisely warns the surgeon not to make the puncture anywhere except through the natural aperture.

Complications occurring as a result of incorrect puncture. Due to injury to the ciliary vessels, there is conjunctival hæmorrhage into the ocular sac. If perchance, excessive haemorrhage occurs due to incorrect and injudicious puncture, mother's milk and clarified butter should be sprinkled over the conjunctival sac. This is the routine treatment adopted in case of haemorrhage.

Susruta describes special treatment for ocular complications arising out of incorrect puncture at different parts of the eye:—If the sclera is punctured in the vicinity of the external corner of the eye in the temporal side. there results chemosis, ciliary injection, pain and excessive epiphora, and discharge of inflammatory exudation. For counteracting this, sprinkling of warm clarified butter and compress (sveda) over the brow are recommended.

When the puncture is incorrectly made in the vicinity of the cornea. the latter becomes inflamed and painful. For treatment, purgatives, sprinkling of clarified butter and venesection with leeches are indicated. If, on the other hand, puncture is made in the upper portion of the cornea, intolerable pain is felt. The surgeon should pour lukewarm clarified butter for the alleviation of the pain. If, however, the puncture is made below the cornea, there would be too much pricking. throbbing or shooting pain and lachrymal discharge and ciliary injection of the eye would occur. In such a condition mother's milk along with glycerrhiza cum clarified butter is to be boiled and the resulting lukewarm decoction poured over into the eye.

If there has been too much laceration of the eye, the result would be intense ciliary and conjunctival injection, lachrymal discharges, intolerable pain, horripilation, and temporary diminution in the visual acuity. The treatment

for such conditions consists in employing enemata, compresses, and oleaginous medicaments.

The complications arising from the use of a defective salaka are discussed by Susruta as follows:—Use of a roughly shaped salaka produce acute and throbbing pain, while an unsmooth salaka will lead to the aggravation of the deranged humour. Ulcer results from the use of a thick tipped salaka, whereas a very sharp salaka would lacerate many vital structures of the eye in many ways and irregular mouthed salaka would bring about excessive lachrymation, and unsteadiness on the part of the surgeon in grasping the salaka would greatly interrupt the operation. Hence Susruta wisely and scrupulously enjoins upon the surgeon to see that the salaka is free from the above defects in order to safeguard and preclude the apprehension of the incidence of complications outlined above.

Susruta mentions the complications accruing from injudicious puncture as well as intemperate diet and conduct of the patient during the post-operative period—redness or intense ciliary and conjunctival injection of the eye, chemosis, sucking and throbbing pain and intra-ocular inflammation are the results. Proper therapy for each of the complications is outlined below:—

For the amelioration and alleviation of acute pain and inflammation, accompanied by ciliary injection, Susruta prescribes the application of a warm medicated plaster composed of Gairika (Red Ochre), anantamula (Indian Sarsaparilla), durba (Eragrostis cynosuroides), barley powder and clarified butter and milk. A plaster prepared from white mustard seed and slightly fried sesamum seeds pasted with squeezed out juice of Matulunga (Citrus lemmata) allays pain and inflammatory injection or a plaster composed of payasa (Cleomme Pentaphylla), anantamula (Indian sarsaparilla), Tejapatra (leaf of lourus cassia), Manjistha (Rubia cordi folia), and glycerrhiza—these being pasted together with the milk of a she-goat should be applied lukewarm to the affected organ. A lukewarm plaster prepared from padmakastha (prunus pudum), devadaru (Pinus deodara), sunthi (dry ginger), pasted with the milk of a she-goat would be beneficial in such cases, or a plaster composed of grape, glycerrhiza and Sausurea lappa pasted with the milk of a she-goat should be applied or a warm decoction of milk with glycerrhiza, grape, sausurea lappa and a little Saindhava (sodium chloride) should be applied. This decoction of milk compound is very efficacious in allaying inflammation and pain. Besides this a decoction of Satamuli

(Asparagus racemosus) Pruthakparni (Uraria picta), mustaka (Cyprus rotundus), Amalaki (Embelica officinalis), Padmakastha (Prunus pudum) and clarified butter cooked with the milk of a she-goat should profitably be applied for the alleviation of inflammation and pain.

According to Susrutian teachings, the varieties of cataract that are most suitable for couching operation are the uncomplicated mature ones—preferably the pearl-shaped varieties and the hard varieties of cataract.

As for the immature cataracts, Susruta taught that they are not suitable for couching operation and in case that is done, the dislocation will only be partial. After a time cataract will appear again attended with severe intraocular complications in such a case.

As for the cataracts attended with complications Susruta warns the surgeon not to interfere surgically until the associated complications are fully ameliorated.

Philoxenes (3rd century B. C.), a great eye surgeon of Alexandria, Herophilos (300 B. C.) of Alexandria, Celsus of Rome (45-50 A. D.), Cladius Galenus (131 A. D.) of Asia Minor—all these eye surgeons extensively practised the Susrutian method of lens couching operation in their days.

The method of lens couching operation as described by Celsus is given below:—He lays down as a rule that when the suffusion is small, immovable and of the colour of sea-water or of shining iron, and if a small degree of light can be perceived at the side, there is reason to hope well of the case. He forbids us to operate until the disease has attained a proper consistence. He directs us to place the patient opposite to the operator, who is to sit on a higher seat, while the patient's head is held by an assistant. The sound eye is to be previously covered with wool. If the left eye is affected, the operator must use his right hand and *vice-versa*. A needle which is sharp and not too slender is to be passed direct through the two coats at a place immediately between the temporal angle and the black of the eye, and towards the middle of the cataract when the needle is perforated far enough, which is readily known by the absence of resistance, it is to be turned so as gradually to remove the cataract below the region of the pupil and this object being attained, it is to be strongly pressed to the lower part. If it remains there the operation is completed, but if it returns, it is to be cut and torn by the needle into many pieces in which

state, they are easier depressed and less troublesome. The needle is then to be drawn out direct and soft wool smeared with white of an egg and other anti-inflammatory applications are to be used. Quiet restricted and soothing treatment will be proper.

Vagbhatta, a devote follower and pupil of the Susrutian school and a great Ophthalmic Surgeon of India in the post-Susrutian period, flourished sometime before the 7th century A. D. He lived in an age in which Cataract Surgery had attained a higher stage of evolution. He recorded his method of Cataract operation in his book known as Astanga-hrdaya-samhita. He had the benefit of the teachings of Susruta, the father of Ophthalmic Surgery.

Vagbhatta divides cataracts into the following varieties, namely :—

1.	Cataract with irregular opacity.	These varieties are not fit for operation.
2.	,, of uneven consistence.	
3.	,, with white curd like consistence.	
4.	,, with thin nucleus,	
5.	Grayish white cataract.	
6.	Bluish looking cataract.	
7.	Reddish looking cataract.	
8.	Diabetic cataract.	
9.	Multi coloured cataract.	
10.	Hard cataract.	
11.	Cataract of the colour of bell metal.	

Vagbhatta wisely taught that cataract which is completely matured and unattended by any complication is fit for operation. The contra-indications for the couching operations are the following :—

Those who are unfit for venesection ; those suffering from inflammatory eye diseases; those who suffer from rhinitis, bronchitis, pharyngitis ; those who suffer from nervous dyspepsia and nervous debility ; those who are susceptible to vomiting diathesis and people suffering from migraine.

The cataract operation is to be performed in an equable season, i.e., when it is neither very hot nor very cold.

Preparation of the patient and Eye :—Prior to the operation, the surgeon should advise that the patient's

body be duly cleansed by purgatives and dietetic regulation and should be freed from any constitutional disease, especially inflammatory condition of the nose, eyelids and disease of the pharynx, etc. The patient's eye should be only washed before operation and surgeon's hands should also be duly cleansed. Vagbhatta advises the operation to be done before noon, preferably in the morning after sunrise. The patient should be seated on a wooden operation table and the surgeon should seat on a stool, which should be as high as the operator's knee.

The patient's eye should be warmed with gentle massage with the fingers of the surgeon. The patient's head should be kept steady. The patient should look steadily towards his nose and should not move the eye in any direction. His eye should be kept sufficiently wide opened and the eyelids retracted by the fingers of the assistant.

Then the surgeon, holding the Jabamukhi salaka (the curved barley mouthed needle) steadily with the thumb and forefinger and middle finger of the right hand in case of the left eye and vice versa, should puncture the sclera on the temporal side just outside the limbus in the horizontal diameter of the eye, and then carefully guide the needle through the natural aperture of the eye on to the surface of the cataractous lens. When the puncture is correctly executed there is exudation of aqueous humour and sound and there will be no pain what so ever. The patient should be given proper consolation by the surgeon. The surgeon should sprinkle breast-milk over the operated eye. Then, with the tip of the salaka, the surface of the cataract will be gently scratched and scribbled so as not to cause any pain. In the meanwhile, the patient would be asked to sniff slowly so as to draw up any phlegm from the eye into the nasopharynx. Light compress would have to be applied to the Supra-orbital region of the eye. By gentle scribbling manoeuvre of the salaka, the lens will be dislodged and pushed inside towards the nose. The proper dislodgement of the lens would be indicated by the clearance of vision. The surgeon would now carefully withdraw the salaka. Then a lint, properly soaked in lukewarmed clarified butter, would be put over the eye, which would be properly bandaged by the surgeon.

After treatment—The patient should be laid quiete and undisturbed in a clean, well-ventilated and properly shaded room. The patient should lean on his left side if the right eye is operated and vice versa: when both the eyes are operated, he should lie flat on his bed.

The patient's head and feet would be shampooed gently with medicated oils. His diet would consist of light liquid articles of food and he should be given enough of fresh milk during the post-operative period. On the day of the operation, he should be preferably given a fasting.

For one week after the operation the patient should be strictly warned not to sneeze, cough, vomit, expectorate, nor regurgitate food, nor should he be allowed to take solid food He should not gaze downwards and should not be allowed to bathe nor to be brushed his teeth.

During the post-operative period, he should be given fasting according to his capacity and resistance. So long as the inflammation and pain of the eye are not subsided, the surgeon should regularly pour warmed calrified butter into the eye. A plaster composed of fried barley powder with clarified butter, Trikatu (Piper longum, dry ginger and black pepper) and amalaki (Embelica Officianalis) should be applied over the eye in case of pain and inflammation. The bandage should be opened every third day, and washed with decoctions of antiseptic and antiphlogistic drugs, and compressed and bandaged up with a fresh bandage. According to Vagbhatta the bandages are to be removed once for all after the 7th day.

The patient should be kept under control, till the vision and accommodation of the eye is restored to its normal state. He should be warned not to look at dazzling lights nor should he gaze at small and resplendent objects.

The translations of Susruta's and Vagbhatta's works at the instance of learned and famous caliphus of Bagdad at the close of the 8 th century A. D. greatly influenced and orientated the surgical knowledge of the Arabic surgeons, who extensively introduced Susrutian method of cataract operation in their ophthalmic practice. From Arabia, Susruta's teachings spread to Egypt, Alexandria, Greece and Rome and through the medium of Latin translations, it extended to the whole of Europe in those days. The Arabic version of-Susruta Samhita goes by the name of "Kitab: shawshoon-al-Hindi" while that of Vagbhatta is known as "Sindhi Sara".

The Arabic surgeons of those days adopted Susruta's methods with minor modifications. They made a limbal incision with a knife and dislodged the lens with a blunt needle, in case of hard cataracts, while in case of soft ones, they used to suck out the lens soft matter through a tube introduced through a corneal incision.

Rhazes, an eminent Arabic surgeon, largely followed Susruta's method of cataract operations and often quoted Susruta as an authority on surgery. Rhazes flourished from 850 to 932 A. D.

Avicenna, the writer of Canon of medicine flourished about 980 to 1037 A. D. He was a great eye surgeon. He has left his notes on couching operation from which we learn that the Arabian surgeons of the day modified Susruta's method by using two instruments, namely, a two edged lancet for corneal incision and a blunt needle for depressing the cataractous lens

Benevenutus Hiero solimitans, who lived in Jerusalem, sometime in the 11th century or 12th century was a most renowned and learned ophthalmic surgeon of the day. He practised lens couching operation extensively.

Luxatio—Lentis (dislocation of the lens)—This may be incomplete or partial or complete (total) acquired or congenital.

Treatment:—In case of Subluxation of the lens without complications, Susruta advises performing the lens couchnig operation.

CATARACT

BY

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Cataract is a disease of the lens. It is very common in hot and dusty countries. In India we find that cataract is more prevalent in the Punjab, Rajputana, Sind, Delhi and the U. P. Of course, in other Provinces we do find but not in such a large number.

SYNONYMS

Hindi-Mota-Bind; Urdu-*Nazley-kai-panutarna*; Bengali-Chani. Telugu-*Anthrakushma.*

DEFINITION

The opacity of the lens is known as cataract. It may be in the lens substance or in its capsule. It may be complete or may be partial. If the opacity is in the lens substance it is termed as "Lenticular" and if it is in the capsule, then it is called "Capsular" and by the combination of these two is produced "Capsulo-lenticular Cataract".

HISTORY

From time immemorial this disease was well known to Indians. Our ancient physicians and surgeons of whom we have some records (Charaka and Susruta) have clearly mentioned the signs, symptoms and treatment of this disease. Egyptians and Babylonians appear to be quite familiar with this disease. It was also known to ancient Greek and Roman physicians. On account of gray appearance of the pupil, they denoted it by the name of "Glaucoma", which word in the course of time changed its meaning. The ancients used to believe that this is formed by pouring out of an opaque liquid between the Iris and the lens, hence they called cataract "Hypochyma." Germans used to call it as "Graner Starr" on account of the gray colour of the pupil, to distinguish it from "Schwarzer Starr" blindness due to fundus disease and "Graner Starr", glaucoma.

In the year 1705 Brissean, a French Surgeon, operated the eye of a soldier. He advocated his theory before the French Academy that the opacity lies in the lens itself and not in front as believed before. At first he was ridiculed but when other proofs confirmed his observations, it soon found general acceptance.

GEOGRAPHICAL DISTRIBUTION

I believe that climate has a great influence in the production of cataract. Had it not been the case, the people of Bengal and Assam would have suffered in the same proportion as that of the Punjab and Rajputana. In my opinion if we see on the map of the world we find those countries are effected most which have got dry, hot and dusty climate.

CLINICAL FORMS OF CATARACT

(A) This may be divided into two viz.,

(1) "Primary"—when it is independent of any other ocular disorder.

(2) Secondary or complicated—when it is accompanied or followed by some other disease of the eye, such as glaucoma, uveitis, etc.,

(B) Cataract may be divided into three varieties according to the part of the lens involved.

(1) Lenticular—when the lens substance is involved.

(2) Capsular—when it effects the capsule of the lens.

(3) Capsulo-lenticular—when it involves both the lens substance as well as the capsule.

(C) According to the rapidity of growth of the opacity. Every opacity begins at first at some special spot in the lens. If it remains permanently limited to that particular spot where it first started, it is termed as "Stationary Cataract", but if it gradually spreads over the whole lens to total cataract formation it is known as "Progressive Cataract".

(1) Stationary Cataract may be divided into :—

(*a*) Anterior Polar—a small white dot is seen at the anterior Pole of the lens.

(*b*) Posterior Polar—a small white dot at the Posterior Pole of the lens, which on account of its deep location, is generally to be discovered only with the "ophthalmoscope".

(*c*) Various uncommon forms are "Central cataract" "Cataracta Fusiformis" etc.

(*d*) Lamellar—This is the most common form of cataract in children. It almost always affects both the eyes. It is either congenital or originates in earliest childhood. It is found in children who have suffered from convulsions. (Arlt). At the same time residua of rickets in the bones and changes in the teeth have also been observed (Horner). According to Peter it has been connected with the tetany of childhood and to this also the convulsions have been attributed. Inheritance of lamellar catarct is not infrequent. After dilating the pupil we see a gray, discoid opacity in the lens surrounded by perfectly transparent marginal portions.

TREATMENT OF LAMELLAR FORM

The treatment of this variety is particulary most important. It is done only when interference with vision is considerable. There are only two operative methods to improve the sight. First is to expose the transparent periphery by means of an Iridectomy, or the lens may be removed altogether. The latter is done in young people by "discission" and in old patients in whom a hard nucleus is already formed this is done by "extraction". Each of these methods have got their definite indications, advantages and disadvantages.

(2) Progressive Cataracts may be divided into three varieties, viz:—

(*a*) Senile—as the name shows it generally occurs in old age.

(*b*) Cortical when the opacity lies immediately under the capsule.

(*c*) Nuclear—when the opacity is in the part of the cortex immediately surrounding the nucleus.

(*d*) Congenital and Juvenile

(*e*) Traumatic.

Progressive cataracts are those which begin with partial opacities at first and then these opacities steadily extend to the entire length and bredth of the lens, with the exception of the nucleus of the lens of the old people which as a rule is harder than the nucleus of the lens of the young patients. In young the nucleus is very soft and the opacity occurs in all the parts of the lens. The nucleus of the lens of old patients generally remains transparent. The time required for the spreading of the opacity throughout the lens varies very greatly. There are cases on record in which the *transparent lens has become completely opaque within few hours*, but generally it takes many years to become complete or total. All cataracts which are of soft consistence are found in patients below 35 years of age and the lens is usually of grayish white colour. In patients above 35 years of age the lens is of yellowish white colour and the nucleus harder.

The following four stages are distinguished in the course of progressive cataract.

(*a*) Incipient Stage.

(*b*) Stage of Intumescence.

(*c*) Stage of maturity.

(*d*) Stage of Hyper maturity,

(*a*) Incipient Stage—

To start with, opacities occur in the lens here and there. They (opacities) are radial, spokes like, the base of which look towards the margin and their apex towards the poles of the lens. In ordinary daylight it is very difficult to observe them, even by oblique illumination, one cannot come to certain definite conclusion. It is only with ophthalmoscopic examination that one can arrive at a correct diagnosis of cataract.

(*b*) Stage of Intumescence—As time goes on more and more spokes and sectors develop. In this stage the lens contains more water than in normal condition and this leads to the swelling of the fibres. The opacity becomes considerable and the swelling causes an appreciable intumes cence of the whole lens which becomes evident by the increasing shallowness of the anterior chamber. This

increased intraocular pressure may sometimes become the cause of glaucoma for the period.

(*3*) Stage of maturity—

During the stage of Intumescence the opacity of the lens becomes total. As soon as this is completed the lens begins gradually to lose water, so that once more it returns to its former normal volume. Thus the lens enters the stage of maturity. Again the anterior chamber becomes normal but the iris reflects no shadow over the lens. This is a proof that the opacity of the lens has become total. Now the colour of the lens has become dull, gray or brown instead of its usual colour which is bluish white. The lens has now contracted so that the connection between the surface of the lens and the capsule is loosened. The lens then lies in its capsule like a ripe fruit in its rind. (Arlt)

Sometimes the absorption of the water stops at this stage of maturity. The cortex then becomes quite fluid aud the nucleus gives a brown shading to it. The nucleus changes its position with the change of the position of the head of the patient This type is known as "Morgagnian Cataract". The whole lens may be converted into nucleus due to the extension of the sclerosed fibres of the lens. Thus the lens becomes hard, dark brown and semitransparent. The pupil looks black and the brownish colour being seen only by oblique illumination.

(*c*) Stage of Hypermaturity—At this stage further changes do occur in mature cataracts. This change consists in the complete disintegration of the opaque lenticular mass. This becomes converted into a "Pultaceons substance" which no longer shows any trace of the original structure of the lens or its formation of sectors. Hence in a "Hypermature cataract" we either see no marking at all, or nothing but irregular spots—no radii, no sectors (Fuchs). When a Hypermature Cataract has lasted for a long time, changes set in which lead to the following complications.

(*a*) Cholestrin or lime salts are deposited in the lens mass.

(*b*) The anterior capsule becomes thickened by proliferation of the capsule cells, so that out of a simple lenticular cataract, a cataracta capsulo-lenticularis is formed.

(*c*) The lens becomes tremulous.

Diagnosis of different stages—

1. *Incipient Stage-Anterior* chamber is normal. Transparent spots are to be found in the lens between isolated opacities. Seen by oblique illumination the opacities are gray; seen with an ophthalmoscopic mirror at reading distance, they appear black against a red back ground. At the very earliest stage the opacities shift with the incidence of the light showing that they are merely differences of refractive index (Parson). In old people the pupils are not so black as those of young patients, in other words they are generally gray. This grayness without opacity is caused by increase in the refractive index of the cortex of the lens in old people. This is due to increase of refraction and scattering of light. Watering of the eye with other signs at the age of 40 or more is a sure sign that cataractous change has set in the eyes.

2. Stage of Intumescence A. C. is shallower. Iris still casts a shadow on the lens. The colour of the lens is bluish white and has a silky lustre, markings of the stellate figure of the lens are very distinct..

3. Stage of maturity—A. C. is normal. Again no shadow of the Iris is seen over the lens but the markings of the stellate figure of the lens are still recognizable.

4. Stage of Hypermaturity—A. C. of abnormal depth, no shadow cast by the Iris, surface of the lens appear quite homogenous (in the case of liquefaction) or shows irregular dots and spots in place of the radial markings of the lens substance.

Hard and soft cataracts—These depend upon the consistence of the lens substance. By "Soft cataract", therefore, we understand one having no distinct hard nucleus; while those cataracts are known as "Hard" which enclose a hard nucleus although the cortex is soft. These hard and soft cataracts are very important to diagnose before operation is done as the section which is to be made generally depends on the consistence, whether hard or soft. Hence, if it is hard a longer and a bigger section is to be made but if it is a soft one an ordinary section is quite sufficient. In "Hard cataract" the nucleus is darker, reddish or brownish in colour.

In rare cases the sclerosis of the lens fibres which causes the development of the nucleus extends beyond the usual limits, so that the whole of the lens becomes conver-

ted into nucleus; such a lens is hard, dark brown and semi-transparent. The pupil looks black, the brownish colour being revealed only by oblique illumination. This type of cataract is known as "Black Cataract."

Aetiology of Cataract.—According to etiology, cataract may be classified as follows:—

(1) *Congenital.*—This is either due to disturbance of development or an intra-uterine inflammation. These cataracts are usually bilateral and often inherited. Heredity has got an influence over non-congenital cataracts and even senile cataracts too. I know many of my patients in whose families good many people suffered from cataracts generation after generation. It is in very rare cases that cataracts are diagnosed immediately after birth; otherwise what usually happens is that the disease is diagnosed after some months when parents observe that the child does not see anything. Therefore, in such cases the entire process of development has been evolved in utero. To this class belong the Anterior and Posterior Polar, Lamellar and occasionally complete cataracts.

(2) *Senile*—This is the most common type. As the name denotes it generally occurs in old age but not so regularly as to be regarded as a physiological attribution of age as in the case of hairs becoming gray. It is rather a pathological process. There is no hard and fast rule for age, it may occur at any time after 30 but generally occurs between 40 and 50. Heredity has also got some influence. It generally affects both the eyes but rarely at the same time, so that generally one eye is in advance of the other in respect to the development of its cataract. The cause is not definitely known. There are local as well as general causes.

Aetiology of Senile Cataract

(*a*) In the process of transformation of the inner layers of the lens into nucleus (Sclerosis) these layers diminish somewhat in volume. Under normal conditions this process of shrinking is conducted so slowly and gradually that the cortical layers are able to adapt themselves to the diminished volume of the nucleus. But if this shrinking goes on with exceptional speed or irregularity, undue traction may be produced and subsequently these layers of the lens which lie between the cortex and the nucleus may separate. In this situation fine fissures are formed in which fluid accumulates, afterwards the adjacent

lens fibres themselves become opaque and thus afford the initial impulse which leads to the opacity of the entire lens. (Becker)

(*b*) Some Scientists are of opinion that this is due to the altered composition of the aqueous as a result of which the epithelium of the anterior capsule is injured. This change in aqueous might be due to local changes in the ciliary processes which secrete the aqueous (Peters) or as the result of disturbances of the general metabolism as occurs in chronic nephritis (Mitchel) or from accumulation of toxic decomposition products (cytotoxins in the body. (Romer).

(iii) Some authorities attribute it to be due to Sun light, because they notice that the first sectors of opacity develop in the lower position of the lens which are most exposed to the Sun's rays as they come from above. That part of the rays that traverse the lens, and particularly the rays of short wave length, are absorbed by the lens. This is proved by the marked fluore-scene that it exhibits. According to the experiments of Burge light especially rich in ultra violet rays is the cause of cataract provided the lens is charged with sugar or certain salts of calcium, magnesium or silicon. It has been further proved that the cataractous lenses do contain magnesium and calcium salts and in cases of Indian Cataracts an unusual amount of silicon is to be found.

If these findings are substantiated for cataract in general, it would seem that the development of cataract would represent the combined effect of light acting in a prolonged or excessive manner on the eye and of some disorder of metabolism acting to charge the lens with sugar or some mineral salts. This sort of combined action may explain glass-blowers cataract but according to Verhoeff and Bell heat and not light is the chief factor in causing cataracts. Voget has produced cortical cataract in rabbits by exposure to radiation of wave length 670-700 within less than an hour. It has been recently shown that certain iron workers specially tin plate mill men and chain-makers do suffer from cataract. It is apparently rare in other Iron workers as they generally protect their eyes with goggles.

(3) *Cataracts due to general diseases.*—The most frequent of this is diabetic cataract. It mainly develops when the amount of sugar contained in the wine is high and it also matures rapidly. It is thought that the cataract is due to the

abstraction of water from the lens which has also been demonstrated by experiments but the more recent analysis of the aqueous in diabetics have, however, shown that the amount of sugar contained in it is very small, much smaller than the amount required to produce opacity of the lens in even experiments. Hence Cataract is not only due to an abstraction of water but is also due to more complicated disturbances in the nutrition of the lens—the nature of which is not yet exactly known. Cataract occurs less frequently in cases of Nephritis, gout, general arterial diseases and cholera (possibly in cases which has reached the stage). Nephthalinic Cataract is due to the application of Nephthol ointments for skin diseases. In this Retinitis develops first and then the cataract is formed (Beucharsd). Other forms of cataract following the ingestion of poisons are those that appear in Ergotism, Rhaphania, pellagara and Tetany. Cataracts sometimes do occur in Epileptic, Eclamptic and perhaps even hysterical cases.

(4) *Cataract due to Trauma.*—All injuries which make an opening in the capsule result in opacity of the lens. Lens absorbs the aqueous however through the holes and thus becomes opaque. It is always unilateral unless and until both eyes are injured at the same time. It also undergoes the same process of cataract formation as the other common types but here the course is very rapid. A special form of traumatic cataract is produced by lightning stroke or electric shock.

Cataract due to ocular diseases.—By this we understand complicated or secondary cataracts which are generally preceded by some diseases of the eye. The following are the most common affections of the Eye-ball which lead to cataract formation.

(*a*) Violent inflammations such as ulcerative keratitis and Irido-cyclitis.

(*b*) Sluggish inflammations in posterior sections of the eye such as choroiditis particularly Irido-choroiditis chronica, myopia of high degree, retinitis pigmentosa and detachment of the retina.

(*c*) Glaucoma in the stage of glaucoma absolutum.

It is of practical importance to recognise whether a cataract is complicated or not as by this fact the prognosis and treatment are influenced.

Subjective Symptoms.—

(1) Dimness in acuteness of vision is noticed. It is greatest when the opacity is central and least when it is at the periphery. With a central opacity the sight is better when the pupil is dilated because the still transparent peripheral portions of the lens are then used for transmitting light. Such patients see better in dim light but in bright light they complain of being dazzled and shade their eyes with hands. The reverse occurs when the opacity occupies the periphery of the lens. The vision is better with contracted pupil as the opacity is covered by the iris; such patients always try to get better light in order to see. They see better by day than by night.

(2) In the beginning the patient complains of black spots in front of the eyes. These "Muscal Volitantes" or "Black-specks" in the field of vision if caused by the opacities of the lens, change their places only with the movements of the eyes and hence always occupy the same fixed position in the field of vision.

(3) Next development is to see the same object double or multiple. It may sometimes have a very disturbing effect. The cause of the polyopia is due to optical irregularities which develop in the lens as it grows opaque so that the image of the object which falls on the retina is not one but several.

No. 23
Senile Cataract
(dark striaeon a red background)

The interference with vision gradually increases with the progress of cataract until finally there is mere perception of light left.

(4) Myopia often develops during the early stages due to increased density and refractive power of the lens. This is the reason why some patients do discard their reading glasses for the time and even use concave glasses for distant vision.

Objective Symptoms--

When examined by oblique llumination it shows a grayish or whitish opacity on a black ground, but when examined with an ophthalmoscope at a distance a black opacity on a red field appears. The pupil is dilated in order that the lens and the fundus may be examined. Opacities of the anterior capsule are distinguished by their brilliant white

true, sharp outline and superficial situation ; During the stage of swelling of cataract the A. C. is reduced in depth but it becomes normal in cases of mature cataract.

Diagnosis—

1. History of trauma, heredity, ocular disorders etc.

2. Examination by oblique illumination or with an ophthalmoscope.

3. Subjective symptoms such as fixed black spots in the field of vision or diplopia or polyopia, dimness of vision and so on.

4. Perception and projection of light.

5. Colour of the lens-grayish white or little blackish white.

Prognosis—

Prognosis always depends on the following three things :—

1. Uncomplicated condition of the eye.

2. The amount of projection and perception of light present.

3. General condition of the patient.

If there is no complication and the perception of light is well the prognosis is always good provided the general health of the patient is not very bad. If all the above three factors are observed carefully and the operation is done under strict aseptic conditions one should hope to get success in all of his cases.

Treatment—

Treatment can conveniently be divided into two parts, *viz.*, medical and surgical.

(A) *Medical Treatment*—

No medicinal treatment whether local or constitutional is of curative value (May and Worth). No treatment by drugs, etc., has any effect upon the progress of uncomplicated cataract (Parsons). In certain cases *Lotus Honey* drops *succus Cineria Maritima* are prescribed with little benefit.

Thyroid (whole gland including para Thyroids) is employed for its favourable effect on the cataract, increasing the metabolic rate and decreasing the permeability of the lens capsule, as well as in regulating the plasma Calcium. Dosage in most cases is grs. 5 once a day. Nitroglycerine

usually in doses of gr. 1/200 to 1/50 T. I. D., is tried without success. Another drug is Pot-Iodide in saturated solution. It is given in doses of 5 drops after meals for its alterative action as well as for its effect on newly formed cataract opacities. Cal. Chloride, and Rubidium Iodide in an ointment basis may be of some use in incipient cataract. (Krishnamurty).

"Lastly, Particular attention is paid to the general health of the patient. With this end in view Cod liver oil is administered for its influence on the general nutrition and also for its vitamin "A" content".

"Laxatives such as pills of aloin, strychnine and belladonna should be used from time to time as the patients often suffer from some degree of constipation.

"Internal medication was used in the treatment of 20 cases of cataract. Five were discharged with 20/20 vision in each eye, four with visual acuity of 20/30 or above in the better eye, and one case did not respond. The remaining ten cases presented varying degree of improvement in cataracts and vision, proportional to the degree of general health and the extent of cataracts when treatment was instituted. Early diagnosis and treatment are productive of best results." (*F. I. Batemann and T. H. Eames. The Eye, Ear and Throat Monthly Dec.* 1933).

Liver Extract has also been used with little success.

Serum Treatment for cataract.—It is now believed that cataract may be cured by inoculation without the need for any surgical operation. This statement is based on a discovery by *Dr. Felix Lavagna, Chief Surgeon of the Manaco Hospital* (*France*). He states that cataract is a microbial disease and as such can be treated by serum. He has done his experiments on guinea pigs with good results (*Times of India*).

Vitamin C in the form of fresh lime or its synthetic preparation and Vitamin B in the form of yeast, when extensively used for prolonged periods prevents the formation of cataract or prevents further progress in immature cataracts. (Ratnakar, Krishnamurty).

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Evolution of cataract Surgery

BY

DR N. K. BIDYADHAR

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Ever since the pre-historic age up to the early part of the 18th century, SUSRUTA'S depression method of lens couching by the anterior route was being extensively followed, with or without modifications, all over Asia and Europe; when in 1745, DAVIEL gave a new orientation to the evolution of cataract surgery, by devising the open method of expression of cataractous lens and performing his first extraction of the cataract. The evolution of cataract surgery entered into a newer and more advantageous phase when lens couching method of cataract operation gave place to extra-capsular method of cataract extraction.

DAVIEL generally expressed the cataract through an opening incised in the lower part of the cornea. He usually performed the simple capsulotomy operation. He performed iridectomy only in those special cases wherein it was found necessary. The earlier eye surgeons used to make the incision in the lower part of the cornea, but as the disadvantages of the lower corneal incisions were found out, they advantageously adopted the upper corneal incision. The present-day surgeons here universally adopted the upper limbal incision as it has been found out to be the best and the safest procedure.

Ever since the inaguration of DAVIEL'S method, the simple cataract extraction (i.e., without iridectomy) has been advocated and practised from time to time. The method is also followed in the present day.

The almost simultaneous discovery of antiseptics (1860-1875 and anæsthetics (1880) revolutionised the scientific evolution of surgery and their introduction into the field of ophthalmic surgery has facilitated the development of open methods of eye-operation.

The providential invention of extra-capsular operation facilitated by the discovery of antiseptics and anæsthetics, certainly heralded the dawning of the evolution of modern cataract surgery.

Cocaine was discovered by ALBERT NEOMAN in 1855. RICHARDSON used it in producing local anæsthesia in

1866, but the credit goes to KOLLER, who in 1883, used Cocaine in ophthalmology. Novocaine was discovered by ALFRED EINHORN of Ohio in 1904.

To combat the disadvantages and the post-operative complications in the shape of iris prolapse, etc., following simple extracapsular cataract extractions, the eye surgeons have devised and adopted extraction with iridectomy. The combined extra-capsular extraction has undoubtedly become the safest operation and has become the method of choice amongst the majority of operators— ELLIOT, HEPBURN, BIRCH HIRCHFIELD. FUCHS, DUKE-ELDER as well as many others. ELLIOT, with his vast experience of cataract surgery, became a great sponsor of this method.

We shall now briefly describe the technique of the combined method of extra-capsular cataract extraction as it is evolved from time to time up to the present day.

Preparation of the patient.—Susruta was the first Surgeon to enjoin upon the patient being bodily cleansed and freed from the deranged bodily humours before being brought to the operation table, that is to say, SUSRUTA strictly held that the patient should be freed from any constitutional disease, as also bronchitis, pharyngitis, rhinitis, etc., before being subjected to operation. VAGBHAT, CELUS, BENEVENUTUS, PAUL, ALBUCASIS, RHAZES, GALEN, AVICENNA and others have equally followed the Susrutian method of preparing the patient. There were no antiseptics and anæsthetics in those days. It was in the middle of the 19th century, after the discovery of antiseptics (1860-1875) and after the discovery and introduction of the anæsthetics (1885-1883) into ophthalmic surgery, that the surgeons began to feel that the preparation of the patient and that of the eye asepetically and anaesthetically is of vital importance to the success of the operation and made the best use therefore, of the services of antiseptics and anaesthetics the introduction of which revolutionised the scientific development of surgery and saved humanity from the septic jaws of death. Preparation of the patient includes a thorough investigation of the patient's oral cavity, teeth, tonsils, ear, nose and throat, accessory sinuses; any other likely focus of sepsis should be eliminated. SUSRUTA'S advice of cleansing the patient's body should be followed, and his advice to cure any disease of teeth, nose, pharynx, etc., should be scrupulously followed to rid the body of toxins. The patient should be examined for the presence of any consti-

tutional disease and a routine W. R. done to determine whether it is positive or negative, the presence of which should receive adequate attention. The attending surgeon would see if such diseases, like gall bladder sepsis, blood-pressure, bronchitis, pharyngitis, tonsillitis exist in the patient for which he should take proper precaution and give adequate treatment. In case of a patient suffering from diabetes, the surgeon should see that the blood-sugar is brought to normal by Insulin and diet therapy, and if practicable maintained normal by strict control of diet. If the patient suffers from chronic pharyngitis attended with dry cough, he or she should be medically treated and should be given a course of auto-vaccine, or in the case of doubt of a septic focus lurking somewhere either in the oral cavity or nasal sinuses, or the naso-lachrymal duct or the ear, a course of prophylactic polyvalent combined autovaccine might profitably be administered to the patient for increasing the power of immunity. The condition of the palpebral conjunctiva, and the lachrymal sac must be determined to see if there is any inflammation, for which proper treatment must be given.

Preparation of the Eye.—The object underlying the preparation of the eye is to make the conjunctival sac with its appendages as aseptic as possible by removing the maximum numbər of organisms. A preliminary bacteriological examination of the conjunctival sac, with that of the lachrymal is absolutely indicated to know whether the conjunctival sac, etc., is septic or aseptic. The usual procedure is to get a bacteriological examination done at least 48 hours before the time of operation, so that there would be enough time for the growth of Pneumococci in the culture media. If the report of such examination reveals the presence of such organisms, as Streptococci, Pneumococci, the operation must be postponed, till after further antiseptic treatment, it is found to be normal on a subsequent examination. "There are some surgeons who do not object to the presence Micrococcus catarrhalis and Pneumobacillus, but these are best regarded as dangerous and a profuse growth of Staphylococcus albus is not entirely devoid of risk." (DUKE ELDER).

The lachrymal sac and the naso-lachrymal duct must be thoroughly examined to see if there is any sepsis, and if such sepis be present it must be cured antiseptically before operation. Any moderate secretion from the eyelids must be treated with 1% Mercurochrome solution or with 2 per cent Silver Nitrate solution.

A brief review of the different methods of washing the the conjunctival sac with antiseptic lotions is given below: The usual procedure is to wash the eye with 1 in 5000 solution of Bichloride of Hg. for from 1 to 2 minutes. HERBERT advocates irrigating the eye with 1 in 3000 Bichloride solution for from $1\frac{1}{2}$ to 2 minutes; SMITH irrigates with 1 in 2000 solution of Bichloride, while CHATTERJE (N) advises washing with Hydrarg: Bin. Iodide solution of 1 in 5000. COLLINS is in favour of using Zinc sulphate solution as a collyrium for eight days prior to the operaiont. ELSCHNIG irrigates both the conjunctival sac and the lachrymal sac with a solution of Oxycyanide of Hg. Finally, irrigating or flooding the eye with sterile Normal Saline solution is the usual routine method in universal use.

For the purpose of counteracting sepsis and creating immunity in the conjunctival sac. the eye surgeons have devised various interesting and instructive methods from time to time. Thus, we have the use made of the injection of 20 c.c. Treuuch's anti-pneumococcal serum before each operation as advocated by MORAX; 1 per cent Optochin ointment has been prescribed by MOREAU to be applied to the lids for the destruction of Pneumococci; autogenous vaccines are administered (Castresana) to inhibit the bacterial growth; VOGHT, depending upon the bactericidal property of blood, washes the conjunctival sac with fresh blood obtained by deep external canthotomy.

In resistant cases, however, where all methods of antiseptic treatment have failed to produce the desired effect, the technique of local radiation of the conjunctiva by ultra-violet light suggested by LAW (1934), provides a way out of the difficulty (*Law. Proc Roy. Soc Med.* 1934, XXVIII. 192). According to LAW, ultra-violet irradiation is successful in nearly every case in rendering the eye bacteriologically safe for operation, even when the other methods fail. The routine method is to give six doses of 5 minutes each at two-day intervals, irradiation being carried out at a distance of about 12"; number of doses may be increased when necessary.

Of course, it must be emphatically said that too much use of antiseptics in the eye does more harm than good, as thereby, the normal resisting capacity of the organ becomes impaired to a great extent owing to the conjunctival tissue being damaged. The writer agrees with Dr. CLAPP when he says that "since the ideal of complete asepsis is practically never attained, the most one can hope for is the

removal of the greater number of organisms". Hence, violent methods of using too much antiseptics should be scrupulously avoided.

The immediate local preparation of the eye is done in the early hours of the operation day. Moderate dilatation of the pupil is done by pouring one or two drops of 1% Atropine solution into the conjunctival sac and if further dilatation is desired, 1 drop of 1% Homatropine is instilled into the eye one hour before operation.

Local Anæsthetisation and immobilisation of the Eye.—Ever since the introduction of Cocaine into ophthalmic surgery by KOLLER in 1883-1884, it is being extensively used as an anæsthetic agent in cataract surgery. Cocaine Hydrochloride is the salt most frequently used; Cocaine Biborate is also recommended for its greater stability. It is dropped in 4% strength every 5 minutes until four applications are made. If anæsthesia is not complete after this, a single drop of 10% solution will suffice to produce insensitiveness. We owe it to THEOBOLD who, for the first time in 1907, suggested the indications for the employment of Adrenalin Chloride (2 to 5 drops of 1 in 1000 solution in alternation with Cocaine in eye operation. Adrenalin not only increases the anæsthetic effect of Cocaine, but it has the additional advantage of checking bleeding (KILLICK).

In the Susrutian age, antiseptics and anæsthetics had not been discovered. SUSRUTA probably managed this with the decoction of certain antiseptic drugs which he used in washing the eye. To arrest bleeding, SUSRUTA advised sprinkling of mothe'r milk into the conjunctival sac. Thus, it is evident that SUSRUTA was the first to know the hæmostatic property of mother's milk and that in the pre-epenephrin days mother's milk took the place of modern Adrenalin.

Novocaine is used in 0.5 to 2% strength in conjunction with sterile Adrenalin solution (2 drops of 1 in 1000 solution). This is used mostly for blocking the facial branches of the lids to produce immobilisation thereof.

Holocaine—used in 2% solution instilled every 2 minutes until 5 instillations are made. The anæsthesia lasts for from 10 to 20, minutes. KNAPP and TOKOK use this as anæsthetic agent.

Butyn—It is used in 2% solution at ten minutes' intervals for half an hour along with instillatian of 2 drops of

Adrenalin 1 in 1000 just prior to operation (CLAPP). DE SCHWEINITZ advocates 4 instillations of 2% solution at 3 minutes' intervals.

Pantocaine—introduced into cataract surgery by WILMER and PATON in 1932. 2 drops of 0.5 % solution instilled into conjunctival sac before the patient is brought to the operation table and then the instillation of 4 drops one after another. The action of Pantocaine is quick and sure, with little toxicity. Hence, the drug is largely recommended for use with perfect safety in modern cataract surgery.

From time to time, there have evolved different methods of inducing paralysis of the orbicularis muscle by anæsthetising the branches of the facial nerve, the involuntary contraction of which, during operation, produces squeezing with its attendant complications of prolapse of iris and vitreous. The principle underlying the induction of paralysis of the orbicularis is to block the branches of the facial nerve by deep infiltration with solution of Novocaine cum Adrenalin.

Von Lint's Method.—VON LINT devised in 1914, his method of paralysing the orbicularis by deep infiltration with 2 c.c. of 2% solution of Novocaine combined with 2 drops of Adrenalin solution 1 in 1000. The injection blocks the branches of the facial nerve in about 10 to 15 minutes.

Wright's Method (1921—1923) consists in blocking the branches of the facial nerve by injecting the lid with 2% Novocaine, and also blocking the main trunk of the facial nerve by injecting into the molar regions towards the stylomastoid foramen.

Elschnig's Method (1932)—Retrobulbar injection of 1 c.c. of 2% Novocaine solution into the conjunctiva.

Fixation of the Eye is done by grasping the conjunctiva with some conjunctival tissue with a fixation forceps, near the limbus on the nasal side below. Some surgeons—AXENFELD, KALT, ELSCHNIG effect fixation of the eye by passing a suture through the superior rectus at its insertion, while other (COPPER) advocate grasping the superior rectus tendon with a pair of fixation forceps, from 5 to 6 m. ms, behind the limbus. BARRAQUER fixes the eye with a large lid elevator and the use of the Landolt forceps placed I m. m. below the vertical meridian of the cornea.

The Incision.—The incisions that are advocated from time to time are the corneal and the sclero-corneal or the limbal.

SUSRUTA, the founder of cataract surgery, in performing the depression method of cataract operation passed the barley-mouthed needle through a point situated just outside the junction of the black and white regions of the globe *i.e.*, the sclero-corneal junction or the limbus and in a line dividing the white portion (Sclera) equally into two segments. SUSRUTA was, therefore, the first to advocate the sclero-corneal puncture as the best and the safest.

Now, a word or two about the comparative merits and demerits of these two incisions:—

Corneal Incision suffers from many disadvantages:—Wound heals slowly due to corneal nutrition being less active; union being weak, any accidental pressure during post operative stage may easily lead to the prolapse of vitreous by the bursting out of the wound, thereby augmenting the chance of intra-ocular infection. The only advantage is that in corneal incision, the prolapse of iris is less liable to occur. In pre-historic age, CELSUS, AVICENNA made punctures through the cornea in doing the couching operation.

Sclero-corneal Incision:—To SUSRUTA must go the credit of being the first surgeon to devise that the puncture, and for the matter of that, incision through the sclero-corneal region is the best and the safest. The advantages are manifold; wound heals quite rapidly and soundly; calibre of the wound is uniform and even. Union sufficiently strong, hence prolapse of iris and vitreous rare; chance of intra-ocular infection almost nil. This is the most advantageous method and one that is universally followed. The only disadvantage which is minor, is that it bleeds which is effectively checked since the introduction of Adrenalin.

"The section which has now been universally adopted in the extraction of cataract is one which involves the limbus over an extent varying between $\frac{1}{3}$ to $\frac{1}{2}$ and which is invariably placed in the upper half of the globe" (DUKE-ELDER).

The surgeon holds the cataract knife, with its cutting edge looking upward, in his right hand in case of right eye and *vice versa*, steadily and lightly between his thumb and the first two fingers. The point of puncture is at or slightly below the limbus on the temporal side above the equator. The point of the knife is lightly but confidently thrust into the point of puncture and after it has pene-

trated into the anterior chamber, it is rapidly passed steadily through it, in front of the iris, to a corresponding point on the other side, where the counter puncture is made. After the counter puncture is made, the knife is slowly and gently pushed on under the scleral conjunctiva upward for about 4 to 5 m.m. so as to fashion a conjunctival flap. The advantage of taking a conjunctival flap is:—the wound seals up quickly, thereby minimising the chance of iris prolapse and post-operative intra-ocular infection. The disadvantages are, however, minor in character—there is a little more bleeding which is checked by Adrenalin; it interferes with manipulation and easy introduction of instruments which would be overcome with a little care and caution. The fashioning of the conjunctival flap is done by many operators; some surgeons, however, make the section with a conjunctival bridge, while others again pass a suture through the apex of the flap and the conjunctiva above and then tie the suture after the completion of the operation,

Historically, we owe it to DESMARRES who devised the method of conjunctival bridge as early as 1588 and utilised it in practice. Subsequently, we find that VACHER (1899), PANSIER (1901), and CLUCKIE (1909) were enthusiastic advocates of this method and popularised its practice.

In recent years, ELSCHNIG (1921), BUTLER (1922), VON PFLUGK (1923), and KILLICK (1923) have practised the method of utilising a conjunctival bridge in cataract extractions and each of them has published his own observation for or against the method. BUTLER says that corneal astigmatism is higher in such cases. ELSCHNIG recommends the operation in high myopia and exophthalmos. According to VON PFLUGK, the method of keeping a conjunctival bridge is indicated in patients with emphysema and heart diseases. KILLICK (1923) reviewing a series of 100 cases of cataracts, removed under a conjunctival bridge, gives a favourable opinion of this method. SALVA (1925) is an enthusiastic exponent of this method in both simple and combined cataract extractions. BUTLER recommends the bridge being made directly upward as otherwise oblique astigmatism will result while some surgeons (EWING and PATON 1921) advise the bridge to be advantageously constructed to one side, as it facilitates the easy delivery of the lens. The utility of keeping a conjunctival flap cannot be questioned, as it has been an important factor in preventing the tendency to prolapse of the iris followed later by intra-ocular infection.

The iridectomy.—Some surgeons are in favour of making a preliminary iridectcmy in certain cases, *i.e.*, in complicated and immature and diabetic cataracts and in cataracts of one-eyed people. PARSONS advises preliminary iridectomy to be performed in immature cataracts. COLEMAN has discusssed the qustion of preliminary iridectomy in the extraction of senile cataracts and CRITCHETT and TERSON recommend it in cases of diabetic cataract.

The Classical Iridectomy.—The majority of the operators usually perform the iridectomy immediately after the incision is made. SMITH, KNAPP, TOROK, ELSCHNIG, SINCLAIR and BARRAQUER and others all perform iridectomy after the incision is made and before the delivery of the lens. "The iris is gently grasped near the pupillary margin and withdrawn through the incision and excised. The amount of iris tissue should not be large" (CLAPP). There are however variations from the classical iridectomy. Thus HESS (1912) advocates a peripheral iridectomy; VERHOEFF (1906) performs a small iridectomy as near the root of the iris as possible; while ELSCHNIG (1911 and 1912) advocates a peripheral iridotomy.

DUKE ELDER (1934), however, holds that "an iridectomy should not be performed until the lens has been expressed. If, during the extraction, the torn anterior capsule is pushed up into the wound, the process of replacing the iris automatically replaces the capsule at the same time, but if an iridectomy has been performed before the lens is expressed, the practically invisible capsule may lie in the wound, and its replacement is difficult and is very likely to be incomplete.', (DUKE ELDER).

Capsulotomy.—In extra-capsular extractions, the question of doing a capsulotomy arises in order to dislocate the lens from its capsular bed. There have evolved various methods of doing capsulotomy. Some surgeons incise the capsule at the time of completing the limbal section by the tip of the cataract knife; some do this by using the various types of cystitomes; while others perform capsulotomy either by use of sharp toothed capsule forceps or by a blunt capsule forceps.

To BENNETT (1919) goes the credit of devising the first method of immediate capsulotomy in the extra-capsular extraction of senile cataract. While passing the point of knife through the anterior chamber over the anterior surface of the lens, the handle is elevated slightly in order to pierce the anterior capsule, thereby slitting up a small section. DUKE

ELDER says that although it requires a slight additional manipulative dexterity, it is the best capsulotomy as it does away with the subsequent introduction of a second instrument. The second method of opening the capsule with cystitome is the one most frequently in use. The Surgeon introduces the cystitome through the corneal incision, and by a process of gentle scribling of the blade on the capsule, the opening in the capsule is made. Amongst the cystitomes that are in frequent use may be mentioned those of VON GRAEFE, ARLT, KNAPP or LANDOLT.

Preliminary capsulotomy is performed by some surgeons (DRAKE-BROCKMANN, HOMER SMITH). It is indicated in immature cataracts. This is a most efficacious procedure of hastening maturation of an immature cataract.

After capsulotomy is done, the lens is to be expressed out of its capsular bed. At this stage the speculum which was put between the lids is to be removed. The surgeon holds a spoon or a hook in his right hand, and a loop with the left. The assistant would be asked to retract the lower lid gently and the patient would be asked to look downwards. The Surgeon would now exert gentle pressure by manipulating with the instrument in the right hand at the lower limbs towards the centre of the globe, at the same time applying counter pressure with the loop upon the posterior lip of the incision. By means of this manœuvre, the lens presents itself in the wound and is delivered out.

The irrigation of the anterior chamber comes in after delivery of the lens. The idea underlying the irrigation is to remove the remnants of soft lens matter either from the anterior chamber or from within the capsule. Intra-ocular irrigation after cataract extraction was first practised by GUERIN as early as 1773, but it was left to McKEOWN to standardise and popularise the practice of irrigation since 1898. The most common solutions that are used for irrigation are Normal Saline solution (Duke-Elder 1934) and RINGER'S solution (CLAPP). Careful replacement of the iris pillars is done after this. The eyes are dressed and bandaged and the patient sent to bed.

We have so far given briefly the technique of the extra-capsular method of cataract extraction. "The majority of the ophthalmic surgeons have always preferred the extra-capsular method of cataract extraction, the technique of which has remainad unchanged, since it was introduced by DAVIEL in 1745" (DUKE ELDER 1934).

But the extra-capsular method is not the ideal method of cataract extraction, as in this operation, the posterior capsule along with part of the anterior capsule still remains and this may grow into an after-cataract, requiring subsequent surgical intervention

Hence, the ideal method of cataract extraction would be the removal of the entire cataractous lens in the capsule without infliction of trauma and too much instrumental interference to the occular structures, both inside and outside.

Therefore, it was but natural that as cataract surgery advanced in its path of Evolution, a method free from the defects of the extra-capsular extraction method would be devised. Hence, we find that towards the latter part of the 18th century, the ophthalmic surgeons began to feel the necessity of extracting the cataractous lens entire in its capsule. Besides eliminating the defects of the extra-capsular extraction, the intra-capsular method has the further advantage in that cataracts can be extracted in any stage of maturity.

We shall now chronologically enumerate the glorious names of the various ophthalmologists who invented various operative techniques in order to introduce and popularise the intra-capsular extraction of cataract.

DAVIEL (1748) is accredited by some with having tried the intra-capsular extraction, but he gave it up due to some disadvantages.

We have it on the authority of HUBBAL that SAMUEL SHARP was the first surgeon to make the corneal incision in cataract extraction with a single knife and recommended the removal of the lens with capsule by use of external pressure. His method was advocated before the Royal Society in April and November 1753.

GREEN (1914) associates the names of the eye-surgeons BEER, CHRISTAEN and MORENHEIM for having developed and perfected the technique of intra-capsular extraction.

Credit must be given to the Pagenstecher Brothers—ALEXANDEA and HERMANN— who in 1865 and 1888 dealt with the subject more elaborately. Their method consisted in the use of a spoon to extract the lens in capsule.

1878 LINDSBERGH published his method of intra-capsular extraction with spoon and application of pressure

In 1884, J. W. WRIGHT advocated his method of intracapsular extraction. He made an incision about ⅓ way down the limbus in the upper part of the cornea and expressed the lens in capsule without prolapse of vitreous by applying digital pressure to the upper segment and counter pressure by the finger of the other hand over the sclero-corneal junction.

In 1888, HIGGINS advocated his own method in which he extracted the lens in capsule by inserting a flexible wire loop to the back of the lens.

The first surgeon to make an extensive utilisation of this method was COL. MULRONEY working at Amritsar in India. MEHER CHAND published MULRONEY'S work in 1894 at Calcutta.

While the intracapsular cataract surgery was yet in its infancy in the surgical nurseries of Europe and Asia, it was left to COL. HENEY SMITH, working at Jullundhur in India, to devise a radical improvement in the technique of the intra-capsular extraction, as a result of which, the intra-capsular extraction method attained a truly scientific status and became so widely popularised and so extensively practised. It is an unique piece of coincidence that cataract surgery had its birth in India more than 1000 years before Christ and attained a high stage of evolution in India in the dawn of the 20th century.

Indeed the publication of SMITH'S method caused a great awakening in the ophthalmic world, leading to the standardisation of SMITH'S method and the elaboration of several other well-known methods of intracapsular extraction.

The different methods of intra-capsular cataract extractions that have evolved from time to time may conveniently be discussed as belonging to the following groups:—

The first method is devised by the Pagenstecher Brothers, and known as the Pagenstecher method in which the cataractous lens is delivered in capsule by introducing an instrument such as a scoop or a loop to the hind part of the lens.

The second method is that invented by SMITH in India; this depends upon the exertion of pressure on the outside of the eye-ball in order to rupture the lenticular ligaments and to express the lens in capsule entire from its fossa.

The third method is that devised by KNAPP. It consists in delivering the lens in capsule by application of traction and external pressure employed either simultaneously or one after another. VERHŒFF, SINCLAIR and ELSCHNIG and others have elaborated modifications of this method.

The fourth method is demonstrated in the Hulen and Barraquer vacuum extraction operations or in the Kalt and Stanculeanu technique. In this method the cataractous lens is dislodged out of its fossa, and removed by grasping its anterior capsule either with special forceps, a vacuum cup or by electro-coagulation.

We shall now give a concise description of each of these methods in the order in which they evolved from time to time.

The First Method of Extraction by Scoop or Spoon.—This method was first described and popularised by the Pagenstecher Brothers, ALEXANDER and HERMANN (1865—1888). By this method, the lens in capsule is removed by means of a spoon, a loop or a lens hook introduced from behind the lens. It was left to BORYSIEKIEWICZ (1880) to draw attention to the drawbacks of the Pagenstecher method. BORYSIEKIEWICZ remodelled the Pagenstecher method in which he inserted a hook between the lens and the iris and then, by rotating the hook backward, he grasped the lens and affected delivery by traction.

In 1922, JOHNSON published a new method of removing the lens in capsule, in which he effected delivery of the cataract by means of a bent spoon and a strabismus hook.

All these methods, however, are not easy going ones, hence, they are not in popular use; but they are to be remembered as important landmarks in the road of evolution of cataract surgery.

Smith's Intracapsular Cataract Extraction.—After preparation of the patient, anæsthetisation of the eye is done by dropping 2 drops of Cocaine solution at 5 minutes' intervals. Eyelids are washed with soap and water; the trimming of the eyelids (outer one-third) is done. Conjunctival sac is thoroughly irrigated with 1 in 2000 solution of Bichloride of Mercury. A catchless spring speculum is inserted and fixation of the eye is done with SMITH'S forceps. SMITH makes the corneal incision by puncturing at the sclero-corneal junction and the incision involves

nearly one-half of the circumference. SMITH completes the incision with the first thrust of the knife, or with the drawing back of the first thrust. Then having made a broad iridectomy, the speculum is romoved, after which the assistant retracts the upperlid with a special strabismus hook, while the lower lid is retracted either by finger or thumb. The surgeon takes a strabismus hook in the right hand and a spatula in the left. With the point of the hook directed towards the centre of the lower third of the cornea, the surgeon exerts gentle pressure directly backwards towards the optic nerve; by highly and firmly exerting pressure with gentle manoeuvre on the hook, the dislocation and final delivery of the lens in capsule is effected.

After delivery of the lens in capsule, reposition of the iris pillars is done. In case of vitreous prolapse appearing in between the edges of the wound, it should be cut off. The eye is now bandaged with antiseptic dressings, and it is left untouched until the 7th or 8th day, when on opening it will be found usually free from any intra-ocular inflammation.

After SMITH'S publication of the intra-capsular cataract extraction method, keen interest in the subject was aroused. Several modifications in the technique of SMITH'S method were made; GREEN (1914) made a small iridectomy in place of a large one; and LISTER (1919) made the use of assistants, one in controlling the orbicularis and the other to retract the lids. In 1926, SMITH himself made a modification in his technique in which the lens was subluxated in its transverse axis till the rupture of the zonular ligament and by application of pressure from below, the lens was finally delivered in capsule.

Knapp's Intra-capsular Extraction Method.—After dilatation of the pupil with Atropine and anæsthetisation with Holocaine the speculum is inserted and left in situ till the completion of operation, unless otherwise indicated. KNAPP makes a large incision involving nearly one-half of the corneal circumference and a conjunctival flap is made at the completion of the section. Iridectomy is now made and the Kalt forceps having been introduced to a point below the pupillary centre, KNAPP grasps the capsule and, with a gentle but firm traction manipulation, subluxates the lens with rupture of Zonular fibres. Then with a Smith's hook, he applies gentle but steady pressure to the lower corneal margin, as a result of which the lens in capsule is tilted up and delivered. The iris pillars are replaced and speculum removed. Atropine ointment being applied to

the conjunctival sac, and a dry dressing is given. KNAPP keeps both eyes bandaged and for the first four days the affected eye is not dressed. KNAPP published his method in 1915.

KNAPP'S technique has undergone a modification at the hand's of VERHOEFF (1916) whose method consists in grasping the capsule with the modified KALT forceps below the centre of the lens and by a process of applying traction forward on the lens capsule combined with application of pressure from below, the lens in capsule is delivered.

Stanculeanu Intra-capsular Extraction.—In 1912, Stanculeanu published his method of intra-capsular extraction which consists in removing the lens in capsular forceps. He dilates the pupil with Homatropine and makes a rather large corneo-scleral section. Inserting the capsule forceps he grasps the lens capsule immediately below the centre. Gentle pressure is exerted to and fro till the zonular fibres are ruptured, after which the lens in capsule is delivered off.

Torok's Method.—In 1916 TOROK published his intra-capsular method. He operated under Holocaine anæsthesia and his corneal incision involved nearly one half of the circumference, with the retention of a conjunctival flap. A small iridectomy is done and pillars replaced, after which he grasps the anterior capsule just below the centre with the Kalt forceps, and makes gently to and fro movements until the zonular fibres are ruptured. Then taking a Daviel spoon in the right hand, he applies pressure at the lower limbus, as a result of which the lens in capsule is delivered, the lower edge appearing foremost. Iris pillars are now replaced. TOROK makes the first dressing at the end of 48 hours.

Elschnig's Intracapsular Method (1931).—ELSHNIG irrigates the conjunctival sac and the lacrimal sac with Mercury Oxycyanide solution and also applies the yellow oxide of Hg. ointment to the lids until bacteriological examination shows the eye to be aseptic. Anæsthetisation of the eye is done by 3% Cocaine solution; the immobilisation of the lid muscles is done by injecting 2% Procaine-Hydrochloride Epinephrine solution into the subcutaneous tissues on the outer half of the zygomatic arch and a retro-bulbar injection of 1 c. c. of the solution is made. Having put the sutures for fashioning a conjunctival flap, a corneal incision involving the upper two fifths of the limbus is made. Conjunctival flap is lifted with forceps and by opening the anterior chamber, a small basal irido-

tomy is made. ELSHNIG grasps with his own capsule forceps the lens at the lowest possible part of the dilated pupil and tosses the lens to and fro by gentle manoeuvres on the forceps for about 8 to 10 seconds. Then by continuing forward traction on the lens, reinforced by gentle exertion of pressure with a hook applied against the cornea at the level of the lower limit of the dilated pupil, the delivery of the lens in capsule is effected. Suture having been tied, the iris is replaced into position by inserting the repositor underneath the flap. Eserine having been dropped into the eye, the wound is touched with 5% Tinct of Iodine, and after applying Eserine Oxycyanide ointment, the eye is bandaged.

Sinclair's Method.—SINCLAIR of Edinburgh is another enthusiastic advocate of the intra-capsular extraction. He published his latest technic of the operation in 1932 which consists in delivering the lens in capsule by the simultaneous action of pressure applied from without by means of an instrument "the Expressor-guard of SINCLAIR and traction from within by means of a specially designed extraction forceps which has a "double cross-action," being opened by pressure of the fingers and closed by releasing the fingers.

Now, we shall describe the evolution of the vacuum extraction method: The Arabian surgeons were the first to use suction methods in extracting soft cataracts from very early times. Next, the Greek surgeons utilised this method in their ophthalmic practice. It was, however, in the beginning of the 20th century that the eye-surgeons began to build up the method of vacuum extraction on a scientific basis.

In 1906, STOWERS described his method of vacuum extraction which consisted in extracting the lens in capsule by grasping the anterior capsule with a hollow spoon connected with a rubber ball.

The method received greater attention and further elaboration at the hands of HULEN who in 1910 published his modified method of vacuum extraction, which consisted in extracting the lens in capsule by means of a hollow spoon connected by a rubber tube to a receptacle connected with negative pressure.

While STOWERS and HULEN are to be remembered for having paved the way of the evolution of the scientific vacuum extraction method, BARRAQUER is to be remembered as the builder of the method; because it was due to the laborious and enthusiastic investigations of BARRAQUER that

the operation of phaco-erises has been raised to a really scientific status in cataract Surgery.

BARRAQUER published his phaco-erisis method in 1917. A brief description of his method is given below:—After dilating the pupil and anæthetisation of the ocular sac, a rather large corneal incision is made. BARRAQUER introduces the erisiphake through the dilated pupil behind the iris, and places it on the lower-half of the lens. When the vacuum pump is turned on, the lens becomes tightly attached to the cup, and by moving the handle of the erisiphake, the lens is rotated round its horizontal axis. This rotation of the handle of the erisiphake facilitates the rupture of the zonular fibres, and the lens in capsule is delivered adherent to the erisiphake, which is a small spoon or a cup on a hollow handle in connection with an air pump capable of creating a finely controlled vacuum.

BARRAQUER'S method has a large group of advocates. FOSTER MOORE (1923); A. and L. GREEN (1921); MARBAIX, URRA, MCDANNALD (1921); GALLEMAERTS (1921); KOEPPER (1923), CROSSLEY, CASTROVIEJO and FISHER (1932) have all adopted BARRAQUER'S method with modifications in individual cases.

The latest evolution in the sphere of intra-capsular cataract surgery comes from the brain of LACARRERE (1932), who advocated the method of extracting lens in capsule by means of diathermy. He uses an instrument known as the 'Electro-diaphake'. After the usual preparation and anæsthetisation of the eye, a limbal incision involving $\frac{2}{5}$th of the corneal circumference is made. After iridectomy the needle of the electro-diaphake is introduced, its point being applied to the anterior capsule below the centre of the lens. As the current is turned on, it passes through the terminals of the instrument into the lens tissue which becomes coagulated and firmly adherent to the top of the 'electro-diaphake'. By the movement of the needle of the diaphake the dislocation of the lens with rupture of zonular fibres is done, thereby facilitating the final delivery of the lens in capsule.

Conclusion.—We have briefly enumerated the various stages through which the evolution of cataract surgery passed ever since the hoary pre-historic age up to the present time.

We have found that up to the middle of 18th century A.D., SUSRUTA'S method of lens couching operation was

exclusively practised throughout the world. Everybody would frankly admit that at a time when antiseptics and anæsthetics had not been discovered, open methods of operation, especially open operations on such a delicate organ as the eye, could not be undertaken for fear of intra-ocular sepsis. Hence, SUSRUTA, the founder of cataract surgery and the first surgeon of the world was prudent enough not to adopt open methods of cataract operation and invented the depression method of lens couching operation which gave him the best results. Indeed, that was the only method left for the treatment of cataract in the pre-antiseptic and pre-anæsthetic days. Hence, SUSRUTA cannot be blamed and branded as a cataract coucher.

The extra-capsular method of cataract extraction is decidedly better than the depression method of lens couching operation. But the extra-capsular method has its defects, as in this case, the capsule is left behind, leading to the formation of after cataract necessitating subsequent surgical intervention. Hence, the best and the most ideal method of cataract surgery would be the intra-capsular method of cataract extraction. After DAVIEL devised his extra-capsular method of cataract extraction in 1745, it did not take long for the intra-capsular method to appear in the field of cataract surgery. Towards the middle of the 19th century, ophthalmic surgeons were busy devising and standardising the intra-capsular method of cataract extraction, and the dawn of the 20th century saw the highest stage in the evolution of cataract surgery.

* The Intra-capsular Extraction in Senile Cataract by Tumbling of the Lens

BY

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The reason which has prompted me to write this article is the fact that since the year 1903, when I first started in the profession, I have performed 147,461 Cataract Operations almost all of them by the Intra-Capsular Extraction. The technique, which I have followed throughout, was devised by me shortly after I first began Ophthalmological Surgery. The popularity of this operation can, to some extent, be imagined by the magnitude of the figure given above. Although I have trained many a surgeon in this operation, but never before, due to some reason or other, I have published its details.

Before describing the technique of the operation, I shall like to recapitulate the reasons as to way I prefer an Intra-Capsular extraction to an Extra-Capsular one. The controversy between these two operations is always going on in all countries, the Indian Surgeons, on the whole, especially the Ophthalmic Surgeons in the Punjab have always favoured the Intra-Capsular method, while elsewhere Extra-Capsular operation is the rule, although Elschnig, Sinclair, and Barraquer have adopted the Intra-Capsular operation as a routine in their clinics. I need not discuss in detail the advantages of one operation over the other, as they are dealt with in most of the Text-Books on Ophthalmology, but there are certain points which deserve greater attention and emphasis. Briefly the advantages offered by the Intra-capsular operation are:—

(1) That it does not require two operations as the extra-capsular operation invariably does; this is specially the case when one is dealing with Indian patients, as they do not like to come back for a second operation.

(2) That the operation can be performed even when the cataract is not completely mature, thereby saving the

* Reproducsd from the Antiseptic Vol. XXXVI, 1939.

patient a lot of suffering which is usually his lot, when he has to wait for a slowly progressing cataract in both eyes to mature. With Indian patients it is almost a matter of necessity to operate on them when they come out long distances from their homes.

(3) As there are no shreds of capsule or lens matter to be caught in the edges of the wound, so the chances of subsequent iritis and cyclitis are reduced to the very minimum.

(4) The ultimate vision after an Intra-capsular operation is very much better than after the Extra-Capsular extraction. There are two reasons to account for this, one is that as the lens and its capsule are removed in toto there is no chance of an opaque capsule to obstruct the passage of light. The second reason, a more potent one, is that when after a capsulotomy operation subsequent discission is performed to tear the capsule, the anterior surface of the vitreous is also torn, and if after some months this surface is examined with a Slit Lamp an appearance something like this will be seen, fine strands of the vitreous body emerging through the pupil. These thread-like projections in course of time tend to become opaque, so interfering with the visual acuity. On the other hand, in an Intra-capsular operation properly performed there is no tear in the vitreous, and the appearance of its anterior surface is quite regular, even untorn slight bulge through the pupil as illustrated.

Against these advantages in an Intra-capsular extraction, there is one very great disadvantage, which if it does occur is a serious matter indeed, that is, the prolapse of vitreous, it is this accident which has led many surgeons to abandon this operation altogether. To combat this complication, I have perfected the method of delivery of lens by tumbling. All the ophthalmic surgeons who have visited my clinic are struck with the rarity of this accident.

In a later article, I shall give the exact figures as regards the incidence of this as well as other complications; here it is sufficient to mention that in all the cases operated upon by me prolapse of vitreous has not occurred in more than ½ to 1 per cent.

Technique of the Operation.—This operation is the method of choice with me and many surgeons have been

trained in my clinic because of its remarkable simplicity, freedom from complications, and little instrumentation.

Indications:—I perform this operation in all types of senile cataract, mature or not, hard or morgagnian cataract. The technique in morgagnian cataract differs from that of hard cataract.

This operation is contraindicated in juvenile, traumatic, complicated, and secondary cataracts. All cases of senile cataract are dealt by me with this operation, and apart from the varieties mentioned above I do not select my cases. It is obvious from this statement that this operation has a very wide applicability.

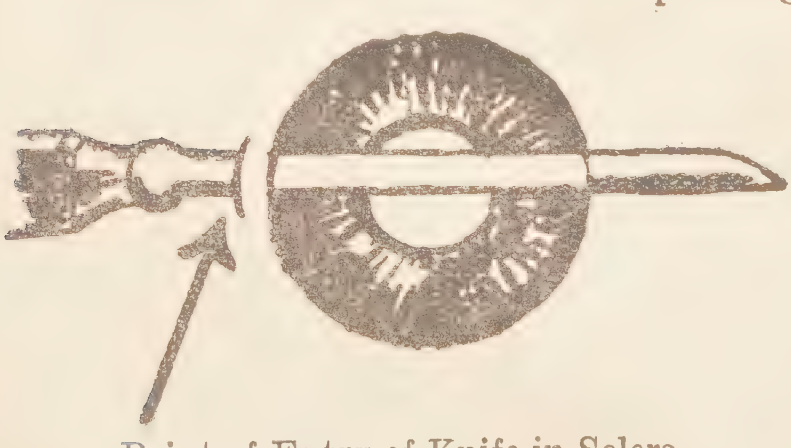
Instruments required:—I have indicated above that this operation is very simple and requires few instruments, they are, one eye speculum, one pair of fixation forceps, one Graefe cataract knife, one iris forceps, one pair of Iris scissors, De Wickers are preferable, and two squint hooks.

A trained assistant who knows what is expected of him at each stage, and who is well versed in the idiosyncrasies of the surgeon is necessary.

Anæsthesia.—2% Butyn solution one drop three or four times at five minutes interval before the operation is the anæsthetic used by me, it gives a fairly complete anæsthesia. I do not use facial block as a routine, this is only necessary in a few nervous patients. It is perhaps advisable for the beginner to employ facial block in all cases.

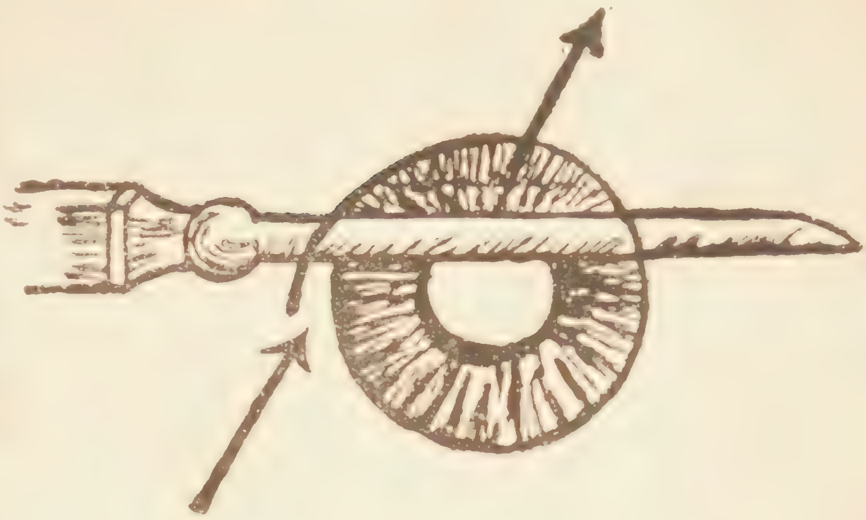
Pre-treatment:—Patient is laid upon the table, and his eye is irrigated thoroughly with 1/5000 perchloride of mercury. The eye-lashes of the upper lid are cut with a pair of scissors dipped in sterile vaseline. Cutting of the lashes is perhaps not necessary.

Corneal section:—After placing the speculum in the eye, the patient is asked to look towards his feet, and the eye is fixed there with the fixation forceps. The Græfe knife is inserted at 9 o'clock (right eye) about one millimeter outside the limbus, this forms a scleral bridge to pro-



Point of Entry of Knife in Sclera, Formation of Scleral Bridge.

2nd Step
Site of finishing the section



No. 29
Scleral Bridge

vide nourishment for the corneal flap. The knife is carried straight across the anterior chamber, and is brought out just at 3 o'clock (right eye, left eye—the section is from 3 to 9 o'clock). With gentle sawing movements knife is carried straight upwards, and the section is finished about 1 millimeter below the upper border of cornea.

It will be obvious from above that I believe in low section, the scar is hidden by the upper lid, therefore it is no disadvantage, on the other hand with a low section the delivery of the lens is considerably facilitated.

With the beginners it is a common fault to press the eye-ball with the fixation forceps; this should always be guarded against, and just before finishing the section the fixation forceps should be removed.

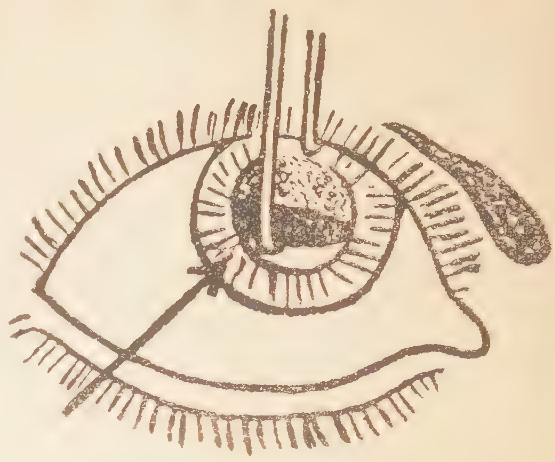
Iridectomy:—I perform a fairly wide iridectomy in all cases, this again makes the delivery of the lens easier without requiring undue pressure on the lens to be pushed through the uncut pupil. Through the corneal wound iris is pulled out with the iris forceps, and it is cut with the iris scissors.

Delivery of the Lens:—At this stage the speculum is removed from the eye, and the assistant lifts up the upper eyelid with a strabismus hook held in his right hand, he pulls the lower lid down with his left hand. The surgeon places his left thumb just above the eyebrow, he slightly pulls the upper eyelid upwards and steadies the eyeball, and in the other hand he takes hold of the other strabismus hook. This hook is now applied on the sclera a few milli meters below the sclero-

3rd Step

No. 30
The hook lifts up the upper lid to show the site where the hook is first applied

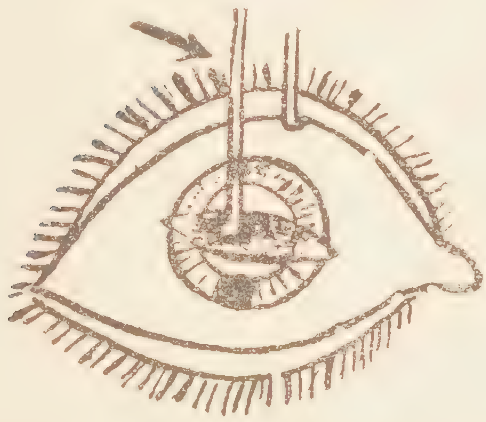
corneal junction at about six o'clock. It is slowly drawn upwards up to the limbus exerting *very slight* pressure backwards. This movement dislocates the lens, it is a mistake to apply too much pressure, this is not necessary, a gentle touch is quite enough. If with the first attempt lens is not dislocated from the zonule, this manoeuvre should be repeated. As soon as the lens is dislocated, the lower pole of the lens is gently pushed upwards with the same hook, and now the lower border of the lens will be seen in the anterior chamber. The hook lifts up the lower pole of the lens still further until it presents in the corneal section. This step is difficult to describe without the aid of photographs, which unfortunately are not yet ready.



Lower Pole of the Lens Supported and Gently Lifted by the Hook. Cornea Intervenes Between Lens and Hook.

It will be gathered from the above description that the lens turns a complete somersault before it is delivered, that is that the lower pole of the lens comes out first through the corneal wound, and the upper pole last and that when the lens comes out, it is the posterior surface which is looking forwards and its anterior surface is lying backwards. This manoeuvre is called 'Tumbling of the Lens,' it ensures that the lens with its capsule is completely free from its attachments before being delivered through the corneal wound, thereby the chances of prolapse of the vitreous are very few indeed.

This hook lifting the lower pole of the lens still further. Now the Lens has turned complete somersault



Previously delivery of Morgagnian cataract used to be carried out by a somewhat similar procedure (the movements of the hook are of course different), but I was the first to attempt the extraction of the ordinary hard senile cataract by tumbling the lens, and now I have trained many workers from all parts of the world who follow this method, and I have no doubt that this operation will gain still further in popularity.

Reposition of the Iris:—After the lens is delivered, Iris is carefully freed from the edges of the corneal wound

and replaced either with the strabismus hook or with an Iris Repositor.

The upper lid is lowered gently, the patient is warned in advance not to close his eyes tightly or in any way squeeze his eyes. The eye is covered with a piece of cotton-wool smeared in sterile vaseline, and both eyes are bandaged.

After-treatment:—Patient should lie prone on his back, and remain quite still for the first 4 to 6 hours, after which he is permitted to turn towards his unoperated eye.

Unless there are any indications which demand examination of the eye on the 7th day, when the unoperated eye is left uncovered.

On the 10th day the operated eye in the absence of complications such as hyphæma, prolapse of the iris, ununited corneal wound, sepsis etc., is unbandaged and covered with a green shade.

Summary.—Like any other surgical procedure a little patience and considerable practice is required before the art of neat delivery is mastered, perseverance is essential, but if it is mastered once, the surgeon will find it a great aid in his cataract operations, he will have acquired a simple, efficient, and a safe method of doing his Intracapsular cataract operations. I have mentioned above that up to the present, I have performed 147461 cataract operations with this way of delivering the lens, and many more have been performed by the various surgeons who have visited my clinic, and all of them have found that it has lived up to their expectations, thereby they have been able to render a great service to humanity as well as to ophthalmic surgery.

* Pitfalls for Beginners of Cataract Operation

BY

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Importance of Cataract Operation in India.—Cataract is so common in India, especially the Punjab, Rajputana, Sind and other parts where heat is excessive, that any medical man whether qualified or otherwise can earn the reputation as an ophthalmic surgeon, if he is able to perform the Cataract operation successfully. Even the quacks who roam about in various parts of India doing couching operation are styled as ophthalmic surgeons or Eye doctors. On the other hand a young ophthalmologist who has passed the highest examination in ophthalmic medicine and surgery, who is quite proficient in the use of Ophthalmoscope, refractionometer, Ophthalmometer, Corneal microscope and Slit Lamp, Perimeter and Scotometer, who can correctly measure the degree of Exophoria and Esophoria, but who has not done a good number of Cataract operations successfully, will have to wait a long time before he earns the reputation as an Ophthalmic Surgeon. In other words, in India a successful Cataract operator is an ophthalmic surgeon of repute. Such being the case every medical man especially those practising in small towns and villages must try to be good cataract operators.

What are the difficulties in being a good cataract operator ?

PITFALL NO 1

First difficulty is to diagnose whether the cataract is in a fit condition to be operated. For this, one must have sufficient knowledge and experience to diagnose a simple cataract from a secondary or complicated cataract. I have seen beginners operating on a Cataract which was secondary to chronic simple Glaucoma, with disastrous result for the patient and a heavy blow to his aspiration to be a well-known ophthalmic surgeon. Therefore the 1st pitfall for a beginner is wrong diagnosis of operable cataract. To save himself from this pitfall he should examine :—

* Reproduced from the Antiseptic Vol. XXXVI 1939.

I. Surface of the Cornea.
II. Anterior Chamber.
III. Margins of the pupil.
IV. Reactions of the pupil.
V. Colour of the Lens.
VI. Projection of Light.
VII. Intraocular Tension.

I. *Surface of the Cornea* should be quite clear if everything is normal. Dullness of the surface suggests Glaucoma. Opacities of the cornea should be borne in mind at the time of giving prognosis in the matter of regaining of vision after the operation.

II. *Anterior Chamber* if shallow rouses suspicion of Glaucoma. If it is shallow without the presence of Glaucoma the operator has to use a very narrow bladed cataract knife. If he fails to do so he cuts the iris at the time of doing incision of the cornea, with the result that the patient squeezes his eye with the utmost force, and lens and vitreous come out as soon as the *incision* is finished. Shallow anterior chamber also suggests swollen lens. Deep anterior chamber is generally seen in eyes with detachment of retina.

III. *Margins of the pupil* should be minutely observed. They should be regular in normal conditions. If found uneven or irregular, posterior Synechia may be present which may be the result of old Iritis. If such an eye is operated, chances of Iritis or Iridocyclitis are very great and subsequent impairment or total failure to regain good vision after operation is quite likely.

IV. *Reaction of Pupil.*—This sign is very important, as good reaction means healthy fundus and chances of recovery of good vision; on the other hand sluggish pupillary reaction or total absence may be due to glaucoma. choroidal atrophy, diseases of retina or optic atrophy. All these conditions would account for unsatisfactory vision in spite of the operation being entirely successful. Absence of pupillary reaction is a contra-indication for cataract operation. If the pupil is found dilated and immobile, it may be due to the use of some mydriatic or some fundus disease.

V. *Colour of the Lens.*—Black cataract is found by dark room examination and always suggests some retinal

pathological changes. Recovery of good vision after operation in such cases is exceptional.

Muddy or brownish colour of the lens may be due to glaucoma or detachment of retina.

VI. *Projection of Light.*—This is to be examined very thoroughly and accurately in the dark room. If the case is normal, projection of light should be very well marked in every direction. If it is limited or doubtful in inner and lower field, it is diagnostic of glaucoma. In these cases intraocular tension should be taken. If projection of light is defective or absent the best thing is to refuse operation.

VII. *Intraocular Tension.*—Normal intraocular tension varies from 15 m.m. to 25 m.m. of mercurry by Schiotz and 22 m.m. to 40 m.m. by Macleans Tonometer. If the tension is above normal, maximum presence of glaucomatous conditions are to be thoroughly ascertained before performing the operation. On the other hand if the tension is much below normal high myopia and detachment of retina are to be kept in mind. Cataract operation done in any of these two conditions will result in disappointment for the patient and the operator.

PITFALL NO. 2

Conjunctiva and Lacrimal Sac.—For a successful cataract operation, it is absolutely necessary that the conjunctiva should be quite normal. In Europe and America, the ophthalmic surgeons are very particular about the healthiness of the conjunctiva. In fact, no case is operated for cataract unless a pad left on the eye for 24 hours, shows no pathogenic organisms from the conjunctival discharge. In India, it is impossible to be so particular in this respect as the majority of eyes that come for the cataract operation are either suffering from Trachoma or Conjunctivitis, or show cicatrical changes in the palpebral conjunctiva as a sequele of chronic Trachoma. The beginner has to examine the conjunctiva and if it is found to be affected with Trachoma or Koch-Week's or Morax-Axenfeld conjunctivitis, he has to treat that eye thoroughly before undertaking any operaticn which involves opening of the eyeball. On the other hand if the eye is found to be suffering from Pneumococcal or Gonococcal conjunctivitis, the operation shouid be strictly refused, otherwise suppuration of the eyeball is quite likely.

Thorough examination of the Lacrimal sac is much more important than the conjunctiva, Even the slightest infection in the sac or simple stenosis, if neglected, results in severe infection of the wound. In every ophthalmic clinic thorough examination of the Lacrimal sac is a routine procedure for a patient being prepared for a cataract operation.

Every case showing even the slightest regurgitation is put aside, and every case in which the fluid injected into the sac does not pass easily in the throat is reported to the surgeon.

Any beginner who fails to be very particular in examination of the sac meets with disasters more often than one who is very particular about this point.

PITFALL NO. 3

I am purposely omitting to draw attention to the lotion to be used for cleaning the eye; Local anæsthetic which may be more suitable, the kind of speculum to be used, fixation of the eyeball and retraction of the lower eyelid, as all these points are fully discussed in the ophthalmic operations.

The greatest pitfall that a beginner meets with and one which troubles him the most is the small corneal incision. Either out of nervousness or inexperience or false ideas of safety against vitreous losses, a beginner generally makes a small incision in the sclero-corneal margins, the result is that the diameter of the incision is smaller than the diameter of the lens to be delivered, and it is impossible to deliver a normal size cataract through such an opening. The only cataract that can be delivered through a small opening is Nucleus of a Morgagnian or milky cataract. The advantages of a small incision are nil, on the other hand disadvantages are tremendous, while a fairly big incision is full of advantages and there are practically no disadvantages unless the knife is entered below the centre of the cornea. I have seen a number of beginners taking more than 15 minutes, trying to deliver a cataract through a small incision, with the result that instead of delivering the lens he delivers most of the vitreous, and the lens sinks down in the eyeball. In the end that eye gives pain to the patient for three or four months and is lost for ever.

In addition to this there is also a great danger of the flaps of the wound getting septic. When the operator

tries to deliver a lens through a small incision there is great bruising of the margins of the scleral as well as corneal flaps of section. As cornea has practically no blood supply and as it depends for its nutrition on lymph supply only the result of bruising is loss of resistance to infection, and serious chance of infection with pyogenic organisms.

PITFALL NO. 4

As every operator for cataract knows so well that, after incision Iridectomy is the next step in spite of good anesthesia of other parts of the eye. Iridectomy is always more or less painful, and if the iris is not handled delicately it gives severe pain to the patient and the patient squeezes. At this time a beginner naturally gets nervous and instead of cutting the iris at once, he fails to do so and sometimes fails to open the iris forceps with which he has caught hold of the iris, and he draws out the iris forceps. Now if the iris is in the grip of the forceps, the whole iris is either torn from its root and taken out of the eye, or certain part of the circumference of the iris is torn or detached from its peripheral attachment resulting in a condition which goes by the name of Iridodialysis. If the eye escapes trauma to such an extent, even the traction on the fibres of the iris predisposes the eye to iritis or iridocyclitis. Therefore to escape from this pitfall the beginner should avoid nervousness on his part entirely.

Sometimes if the beginner fails to introduce the Iris forceps further up towards the margin of the pupil he holds the periphery of the iris, and the result is that instead of doing a good iridectomy he performs what is called a button hole in the iris. The consequence of this pitfall will be difficulty in delivery of the lens. The lens can neither come out from the pupil, nor a small coloboma in the peripheral part of the iris. To avoid the mishap, the beginner should be careful to introduce the iris forceps deep down in the anterior chamber, and to catch hold of that part of the iris which is nearer to the margin of the pupil.

PITFALL NO. 5

Difficulties in capsulotomy:—Under this heading, omit purposely any remarks on the use of capsule forceps as I presume that a beginner always gives preference to a capsulotome. In the use of capsulotome one has to be very delicate in his manipulation. Usually a beginner either

fails to cut the capsule or exerts so much pressure that the hyaline membrane of the vitreous gets ruptured, and vitreous presents itself in the wound before the delivery of the lens. The result is catastrophe, the lens deeps down in the vitreous and unless a vectis is used at once with dexterity the eye is lost.

PITFALL NO. 6

As every beginner knows, this is the most taxing part of the operation. An experienced operator, if he has done large enough incision, good Iridectomy and wide capsulotomy, knows fully well what amount of gentle pressure is required for delivery of the lens. At the same time he knows thoroughly in what part of eye pressure is most effective in delivery of the lens. A beginner either fails to exert the required amount of pressure or exerts too much pressure. In the first case he fails to deliver the lens, in the second case he puts out vitreous instead of the lens. It is only by experience that one learns as to what amount of pressure is within the limits of safety. Sometimes a small lens, especially in a morgagnian cataract with sharp margins, sticks itself in the Scleral flap of the incision, and then any amount of pressure on the lower part of the eyeball fails to deliver the lens. The only technique that would succeed is to apply gentle pressure about 2 mm. above scleral flap and push the margin of the lens in the lower direction, so that the margin of the lens may present itself in the sclero-corneal wound.

After delivery of the lens all the lens matter should be removed; either by gentle pressure on the cornea or by use of a small irrigator and washing out the anterior chamber. Even a slight amount of lens matter or a piece of loose capsule left behind, would be a source of iritis, plastic in nature, or if there are other predisposing causes, constitutional or local Iridocyclitis may come off.

PITFALL NO. 7

Failure to replace pillars of the Coloboma of the iris in the angle of the wound.

Generally a beginner breathes a sigh of relief, when he succeeds in delivering the nucleus of the lens, and in a hurry omits to attend to the step of operation which goes by the name of "toilet of the wound".

Really speaking the most important step in the toilet of the wound is avoidance of any incarceration of the iris

or lens capsule in any part of the wound. Failure to do this will result in prolapse of the iris in the first case, and onset of secondary glaucoma in the second case. Therefore, never fail to pass an iris repositor in the whole wound from one end to the other.

DISEASES OF THE VITREOUS

Opacities of the Vitreous.—These are quite common. They are generally due to changes in the vitreous itself or due to disease or haemorrhages from the neighbouring structures such as the retina, the choroid and the ciliary body. High grades of myopia and atheroma of the blood vessels may bring forth opacities. Floating specks may also be seen in normal eyes as transparent threads or strings of pearls but the individual may not notice it at all since they do not obstruct or disturb the vision. These are caused by shadows cast upon the retina by the cells normally found in the vitreous. They often accompany errors of refraction.

The opacities in general vary and possess different shapes, sizes and numbers, in different diseases.

The vision is greatly disturbed. This depends upon the size, the situation and the thickness of the opacities. The patient often complains that he sees moving specks before the eyes and says he can see clearly at times and at times he cannot see objects quite clearly. This alarms the patient. This is due to the movements of these opacities. In course of time patients will be accustomed to these opacities and they try to move the eye ball in such a way as to throw the opacity out of the line of the sight.

Treatment.—The specific cause, if any is to be treated. If there is syphilis anti-syphilitic treatment should be adopted. Large quantities of iodides, mercury, courses of sweats and laxatives internally are given. Injections of normal saline under the conjunctiva are also tried.

Susruta describes Nakulandhya (diseases of the vitreous, opacities of the vitreous) which is more or less characterised by disturbance of vision in consquence of which the external objects appear to be of variegated colours and shapes.

The prognosis is unsatisfactory. Treatment is directed towards the amelioration of constitutional diseases and improving the general health of the patient. The principles

of treatment outlined in the treatment of Pittaja and Vatja abhisyanda will be followed according to the indications of the disease.

DISEASES OF THE ORBIT

It comprises the following:—(1) Periostitis, (2) Orobital cellulitis, and (3) Thrombosis of the cavernus sinus.

Periostitis.—(Inflammation of the orbital bone) Generally the orbital margin is affected, and more rarely the deeper portion of the orbit. It is either acute or chronic. The chronic periostitis takes a long course. Syphilis, Tuberculosis, trauma, and suppuration from the accessory sinusis of the nose are the chief causes.

Signs and symptoms.—

Marginal Periostitis.—The lids and the conjunctiva are swollen and oedematus. On feeling, a hard swelling is seen on the orbital margin with tenderness on pressure over the area.

Deep seated periostitis.—It is difficult to diagnose because nothing is seen from outside. Signs and symptoms of deep inflammation of the orbit are seen.

The periosteal inflammation either turns favourably or may lead to suppuration and end in an abscess.

Treatment.—The cause is to be treated. Sulphanilamides may be tried with some benefit. Hot fomentations over the inflamed area does some good. When there are definite signs of abscess formation the abscess should be opened immediately.

TUMORS OF THE ORBIT

The most common tumors are dermoid cysts, osteoma, sarcoma and carcinoma.

Dermoid cyst.—It generally lies in the anterior portion of the orbit and lies under the skin of the lid. It bulges forwards and is easily felt when palpated.

Treatment.—Removal with its capsule is the only treatment. Care should be taken to see that no tearing of the capsule is done during the procedure lest it should recur.

Osteomata is also rare. It proceeds from the bony wall of the orbit specially from the frontal bone. They are very hard, slow in growth, displace the bulb from the orbit, and destroy the vision by compressing the optic nerve.

Treatment.—Removal is the only course. Enucleation may be necessary.

Sarcoma.—This is the most common form of Malignant tumor that arises out of the orbit. It may arise from the periosteum, the muscles, the lacrymal gland, the nerves etc. The tumor grows rapidly at first displacing the eyeball and later on destroying the eye. The neighbouring lymph glands are enlarged.

The tumor may extend into the brain or into the neighbouring cavities. Death sooner or later is inevitable.

Prognosis is grave.

Treatment.—Removal of the growth is the proper treatment. Radium and X-ray are advocated by some surgeons.

Carcinoma.—It is very rare in the orbit.

DISEASES OF THE ORBIT (Ancient)

For the inflammatory diseases of the Orbit, resulting from injury or hurt to the organ the eye is to be soothed by the application of compresses, nasya (snuff), dhuma (fumigation), plaster etc., mentioned in connection with the pittaja Abhisyanda.

Tumours of the Orbit.—Benign and Malignant, Treat. ment mainly surgical by chhedana (Excision) operation. The prognosis of benign tumors is good, while that of Malignant ones is grave (Asadhya).

Some Observations on Primary Glaucoma

BY

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Glaucoma is a disease of the eye in which among other symptoms, the most predominent is the increase of tension. It has often been quoted that "Glaucoma is a sick eye in a sick body", but the most careful examination fails, in numerous cases, to reveal the presence of any constitutional disorder, a few of the patients being in the prime of life. It is more than probable that in a certain percentage of cases, Primary Glaucoma is a local disease of the eye-ball, heredity playing an important part. It is not established with certainty whether the Aqueous humour is a dialysate or a secretion, but whatever the case may be, the composition of the Aqueous plays an all important part in the preliminary stages of Glaucoma.

The vascular structure of the ciliary body is responsible for the production of Aqueous and any alteration of its vaso-motor control by promoting dilatation of the capillaries leads to alteration both in the quality and the quantity of the contents of the Anterior Chamber, throwing extra work on the excretory apparatus. In normal eyes, that is, eyes which are not predisposed to Glaucoma, the filtration angle is capable of making good any exta demand made on its power of exit, but in eyes with congenitally inefficient passages of outflow, the variation of the composition of aqueous which contains more protein or histamin, the excretory passages are not capable of bearing the extra work. The result is that the intra-occular fluid is locked up in the eye, giving rise to high tension.

All congenitally predisposed eyes do not always lead to Glaucoma, as is shown in the following two interesting cases. Two sisters, first seen by me twenty years back were found to have had particularly shallow anterior chambers; the elder one had for purposes of a nasal operation, a subcutaneous injection of atropine administered. The result was that she developed congestive Glaucoma for which

a trephine operation was performed. She developed traumatic cataract and ultimately lost the vision completely. Ten years later, the other eye developed an attack of congestive Glaucoma and was trephined by a Surgeon of great experience. Once again she developed traumatic cataract and iridocyclitis. Incidentally, to my mind in this particular case, the predisposing cause of Glaucoma was an unusually large size of the lens, which caused injury to the lens during the trephine operation. The other sister, although passed the age of sixty so far has not developed the signs of high tension.

THE EARLY DIAGNOSIS OF GLAUCOMA

The perimeter and the tonometer afford the best means for the earliest diagnosis of glaucoma. The tonometric pressure curve of even a normal eye, shows a diurnal variation, the highest pressure being recorded between the hours of 5 A.M. and 7 A.M. One of the causes of this rise of pressure early in the morning is due to the fact that during sleep the eye is at rest, and the external ocular muscles are not active. The movements of the eye, plus the actions of the extrinsic eye muscles have a massaging influence on the sclera, which helps to keep the tension a bit lower. In diagnosing early glaucoma, it is absolutely necessary to take the tonometric measurement early in the morning, that is, at a time when the physiological tension of the eye is at its highest. In difficult cases when we are in doubt as to the eye being glaucomatous, many provocative measures are taken which are apt to increase the tension. The variation of tension observed in a healthy eye after the provocative measures is trivially modified, whereas in the Glaucomatous eye difference may amount to 6 or 8° (Schiotz) or more. The same diurnal pressure curve is observed in chronic, simple chronic, congestive and prodromal state of acute glaucoma. To sum up, it is best to take repeated tonometric measurement at 7 o'clock in the morning and at about 6 o'clock in the evening, and compare it to the normal variations. One is apt to find the pressure curve crossing threshold of the physiological limit in latent glaucoma cases. After this has been tried, one must proceed to administer provocative measures which are known to cause increase of pressure in eyes inclined to high tension. Of the numerous provocative measures that have been in vogue, possibly the best is the "Dark Room Test", which is performed in the following way. The tonometric measurement is first taken and then the eye is occluded with a dark bandage so that it is shut off from all light. After an hour, the

bandage is removed and a second tonometric reading is taken. In normal eyes there would be scarcely any variation in the measurement, whilst in glaucomatous eyes, the variation would amount to 6 millimeters (Schiotz). Furthermore, if the patient is asked to look at a bright light, the tension falls rapidly to its former level. Administration of coffee, compression of the jugular veins, or keeping the head lower for an hour, are measures used in provoking a rise of occular pressure.

THE PERIMETER TEST

The most reliable results for the recognition of early Glaucoma can be obtained by the Perimetric Test, specially by the Bjerrum Screen. Arcuate scotoma surrounding the fixation point with the central visual area intact, indicates one of the earliest objective signs of glaucoma, also enlargement of the blind spot specially in the vertical direction as measured by the Campimeter. These small depressions in the visual field disappear, on the administration of miotics.

The light sense in glaucoma fails quite early and the patient requires a stronger light in order to see objects. With intelligent patients this test could very well be performed in the dark room, the surgeon making the patient count his fingers whilst another assistant, presumably a normal sighted man, with his eyes on the same level as the patient, compares his own capacity to that of the patient. When both eyes of the patient have normal refraction and vision, the patient himself can very well judge his visual acuity in the dark room comparing one eye to the other. There is a special apparatus made by Zeiss to measure the minimum of light sense,

THE MEDICAL TREATMENT OF GLAUCOMA

It is possible to keep the patient under the influence of a miotic for a number of years with checkings of the tonometric measurement at regular intervals of two months or so to see that the drug does not fail to keep the tension on the physiological threshold.

THE USE OF DRUGS

Pilocarpine nitrate 2% solution is the drug of choice for continued use, and it is best to dissolve it in a buffer solution to keep the pH constant. Pilocarpine could

be used even in a 6% solution without disagreeable effects. In order to buffer the solution of Pilocarpine, "Boro Pilocarpine" has been used which contains beside the Pilocarpine salt, free Boracic Acid. If the alkali of the tears are added to this solution, the concentration of the ions of hydrogen are but little changed. With this buffer effect considerable absorption of the alkaloid takes place. Pilocarpine ointment 1% is also used, the effect of this lasting for a longer time than those of the solution. Histamin under the name of "Amin Glaucosan" is also used, but it is not generally recommended owing to its irritative effects on some eyes which may even lead to the formation of a Hypopion. Doryl in ·75% solution is also used instead of a 2% solution of Pilocarpine. It cannot be too strongly emphasised that the conservative treatment of Glaucoma is only allowed when the patient is under constant control of the surgeon and if it fails to keep the tension under control operative interference should be immediately considered. It will not be out of place to mention here, that if the instillation of Pilocarpine has to be done for years, an allergic conjunctivitis is apt to be developed and the Pilocarpine has to be temporarily stopped and some other drug such as adrenaline solution substituted.

THE CHOICE OF AN OPERATION

Every Ophthalmic Surgeon should be capable of performing two or three types of Glaucoma operations for the relief of high tension. When the function of the eye deteriorates inspite of the use of miotics, then without hesitation, operative interference must be thought of. There are four operations in common use, namely, the Trephine, the Cyclodialyses, the Iridencleisis and the broad Peripheral Iridectomy. To this may be added the operation of Trabeculotomy of Otto Barkan in which the Schlemms canal is opened by a knife in the anterior chamber. It is difficult and technical operation in which the canal is cut up from within. It is done by the aid of contact glass and intense illumination.

Of all the operative procedures, the simplest and the easiest is iridencleisis operation, .which can be performed as follows :—

(1) The eye is cocained as usual, a few drops of 1% solution of Novocain is injected into the Superior Rectus Muscle. This paralyses the muscle and prevents the eye from being turned upwards.

(2) The conjunctiva is separated as in Elliot's Trephine Operation, but when reaching the top of the cornea, it is not necessary to push the dissection into the corneal tissue. The conjunctiva in the limbal region is adherent to the sclera and therefore it is advisable to place the filtering area away from it.

(3) With a specially constructed knife — Elschnig's Scalpal, an incision is made in the cornea so as to open the anterior chamber from above, the incision must be wide, as wide as one makes when performing the operation of broad peripheral iridectomy. A narrow incision is apt to produce a localised, raised filtration area, where the conjunctiva is liable to become very thin in course of time, with the attendant risk of septic complication of the scar. A bigger incision produces a large filtering area, which is not much elevated from the neighbouring area.

(4) Usually the iris bulges out as soon as the anterior chamber is opened, if not the iris knuckle is gently pulled out.

(5) The protruded knuckle of the Iris is now snipped with iridectomy scissors at three or four places.

(6) The conjunctival flap is now sutured up and a drop of atropine instilled.

There is no need for keeping the patient indoors after this operation, specially if there is no hyphæmia during the operative procedure.

There is scarcely any after treatment in the vast majority of the cases, but a gentle massaging of the eye should be started after the 10th day. In very successful cases, after a few months, the whole operative area is converted into a mass of filtering fibrous tissue. In such cases there is not the remotest chance of sympathetic ophthalmia.

Of late Prof. Vogt has instituted a new operation of glaucoma in which more than a hundred punctures are made in the tissues of the sclera in the hind region of the ciliary body by means of a very short sharp diathermic needle. The length of the needle is such that it only just pierces the sclera and the diathermic current burns and atrophies a part of the ciliary body. In my hands the

results are disappointing in 50% of cases. The operation is easy to perform and free from danger.

B. P. BANAJI F. R. C. S. I.

GLAUCOMA (GAMBHIRIKA) (*Ancient*)

According to the teachings of Susruta, Gambhirika is characterised by increased intraocular tension, due to the abnormal derangement of Vayu (Nervous force) accompained by intolerable pain, gradual contraction of visual field (drustivirupa) and excavation of the optic disc (Sankochamavyantara)

As regards its prognosis, Susruta taught that the disease known as gambhirika is difficult of cure (Krchhrasadhya)

As for the symptomatic treatment, the therapeutic measures mentioned in connection with vataja abhisyanda and adhimantha would be adopted in this case. Special therapeutic measures are Tarpana and putapaka and application of lekhana and Snehana anjanas which would help the amelioration of the disease by relieving the intraocular tension and soothing the deranged Vayu (nervous humour).

Diseases of the Lid

BLEPHARITIS

The inflammation of the lid border is known as Blepharitis. It occurs under three types.

(1) Non-ulcerative, (2) Ulcerative and (3) Angular.

The causes of Blepharitis are either general or local.

General causes :—Blepharitis in these cases is always bilateral.

(1) Anaemia, Scrofula and Tuberculosis-These are the common causes in children.

(2) Sleeplessness, Bad hygienic surroundings, smoke, Heat etc.

(3) Local causes :—Chronic catarrh, Conjunctivitis Eczematosa, Trachoma, Dacrocystitis and Unilateral Blepharitis.

(4) Errors of refraction such as Hypermetropia and Astigmatism.

SYMPTOMS AND SIGNS

1. *Non-ulcerative Blepharitis.* The lid margin is swollen, reddened and presents numerous whitish scales at the bases of the lashes. There is no ulceration of the lid margin.

2. *Ulcerative Blepharitis* :—The edges are reddened. swollen and present yellowish crusts which glue the lashes together. Small ulcers will be seen at the route of the lashes when the crusts are removed. The lashes fall out freely and do not grow again.

3. *Angular Blepharitis* :—It is only a synonym for Diplobacillary catarrh. It is charactrerised by redness and maceration of the lid borders. The skin adjoining the angles of the eye is also macerated. In all these varieties there is itching, sorness, epiphora and sensitiveness to light.

Treatment :—General and Local.

General : The general health should be improved by giving tonics, fresh air, and avoiding dusty and smoky atmosphere.

Local :—If the tear sac is diseased it should be removed. Trachoma or chronic catarrh if present should be treated side by side with this treatment. The crust and scales clinging to the lid margin should be carefully removed by washing with alkaline water, both morning and evening. After that a mild salve like Unguntum Boric, Zinc or white precipitate ointment should be smeared over the raw surface. The salve can be applied two are three times a day if necessary. In ulcerative Blepharitis, the lashes also should be removed. Solid silver nitrate stick may be applied over the ulcer to hasten healing. Sulphanilamide cum Zinc ointment may be tried in these cases.

If the patient is Hypermetropic, Myopic or Astigmatic, proper glasses should be advised for wearing.

DISEASES OF THE LID (VARTMA-MANDALA) ANCIENT

Susruta described three types of blepharitis, namely :—(1) Non-ulcerative, (2) Ulcerative, (3) Gangrenous or angular.

Etiology of Blepharitis, according to Susruta are bad hygienic conditions, exposure to heat, smoke, dust, under nutrition and lowered resistance, chronic catarrh and constitutional diseases resulting in derangement of bodily humours.

The symptoms of the different varieties of blepharitis are given below :—

1. *Syava-vartma* (Blepharitis ulcerosa) characterised by a dark brown discolouration of the eyelids, marked both internally and externally by chemosis and accompanied with a discharge of pus, with burning and an itching sensation.

2. *Kardama-vartma* (Blepharitis non-ulcerosa) marked by the eyelids being swollen and reddened or copper coloured without ulceration of the lid margins.

3. *Praklinna-vartma* (Acute gangrenous blepharitis) an external swelling of the eyelid with deposit of mucous matter in its inner surface attended with a slight pain as well as discharge, itching and pricking sensation. Treatment of Blepharitis, according to Susruta, is both local and general. General treatment consists in attending to the general health of the patient by giving him energising and vitaminous foodstuffs such as enough of milk and fruits and by keeping him in good hygienic surroundings. Internal and external cleansing of the patient's system is also emphasised.

Local treatment consists in mild antiseptic, antiphlogistic lotions such as that of Daru-haridra (Berberis asiatica) and triphala (Terminalia Belirica, T. Chebula and Embelica officinalis etc.) Salves, however, play the main role in the treatment of inflammatory diseases of the eyelid. Their action is mainly ascribed to the oil which softens the scales and crusts and facilitates their removal.

Hirakas (ferrous sulphate), Samudraphena (Sepia officinalis, Rasanjana (Extract of Berberis asiatica). and buds of Jati flower (Jasminum grandi-florum) pounded and pasted together with honey would be efficaciously applied as an anjana in a case of praklinnavartma. An anjana prepared by pasting resanjana with honey or clarified butter is to be profitably applied in a case of blepharitis.

An eyelotion prepared by boiling musta (Cyprus rotundus), Haridra (Curcuma longa), Glycerrhiza, Lodhra (symblocos Racemosa), Anantamula (Indian Sarsaparilla), Priyangu (Aglaia Roxburghianna), and sarsapa (Brassica samprestris) with pure disilled water or rain water would be employed in Praklinna-vartma as well as the other types of blepharitis.

Saindhava, manahsila (realgar) and Sobhanajana seeds with the expressed juice of Citrus Limmeta are made into an anjana, which, once applied, allays itching immediately.

In the type of ulcerative blepharitis, an astringent and oleaginous ointment would be used after the eyewashes have been removed. Surgically, Susruta treats blepharitis ulcerosa and squamosa with lekhana (scarification) operation.

HORDEOLUM (STYE)

It arises from suppuration of one of *Zeiss'* glands situated in and around the eye lashes. It generally ends in an abscess. It is often accompanied by pain, tenderness and with considerable oedema. Styes generally appear at all ages. Chronic constipation, general debility, and uncorrected errors of refraction are the most common causes.

Utsangini (*Hordeolum or stye*)—Susruta defines utsangini as an indented boil or eruption (pidaka) occuring along the exterior of the lower eyelid with its mouth projecting inward.

The Pidakas in utsangini generally end in abscess formation. They are accompainied by pain, tenderness and œdema. They occur in all ages, generally in people with deranged humours.

Treatment :—Hot comapresses, antiseptic and antiphlogistic eyewashes in the early stage are indicated. Decoction of Berberis asiatica should be poured twice daily into the eye.

In case of utsangini when ripe, the affected part would be cut with the vrddhipatra sastra (cutting knife) and then carefully scarified and scribbled with the vrihimukha sastra (the scarifiing knife)

CHALAZION

It is a benign Tumor of Meibomian gland accompanied by the chronic inflammation of the surrounding Tarsus. It is chronic in course and will never suppurate. It appears as a firm swelling in the lid and gradually increases till it attains the size of a pea. It is freely movable under the skin. On everting the lid one can easily notice a discolouration of the conjunctiva and slight bulging or presents a small mass of granulation tissue. Sometimes the chalazion may disappear or mostly it remains as it is for years without any inflammatory symptoms. It is most common in grown-up children and adults. Owing to the bulging of the tumor it causes disfigurement and constant irritation to the eye.

Treatment.—It is better to leave very small chalazions entirely alone. Yellow salve may do some good. Larger once should be removed by operation.

Kumbhakini. (infracts of the meibomian glands or chalazion) is defined by Susruta as boils or pustules of the size of Kumbhika (pistia stratiotes) appearing at the junction of the eyelid and the eyelashes, the rupture of which is followed by inflammation.

Treatment :—Surgical by the lekhana (scarification) operation.

Herpes Zoster :—It is a disease of the skin of the lid with formation of vesicles at the expanded end of the nerves (Branches of Trigemnal nerve.) Usually the out break of the herpes is preceded by a number of days of severe neuralgia in the territory of the nervous trigemnous. This is followed by the appearance of the vesicles on the reddened skin. Fever often accompany the disease. Most commonly the first branch of the nerve is involved so that one finds these vesicles on the upper lid, the forehead, and on the nose. When the territory of the second branch is affected these vesicles appear on the cornea, on the lower lid down to the lower part of the face. The vesicles

at first contain a clear fluid. Later on it turns to pus and the vesicle finally dries down to a crust. The ulcers leave permanent scars unlike those of Herpes Febrilis.

The disease generally affects the old people. The affection is due to the disease of the gasserian ganglion. The prognosis is always good except in corneal affection.

Treatment:—It is purely symptomatic. Dusting powder like Zinc, Boric and Bismuth subcorbonate may be dusted over the ulcers. Internally, general tonics like Iron will be useful. Salicylates and opium should be given when there is an acute pain. The injection of Alcohol into the gasserian ganglion is advocated to paralyse the nerve. Vitamin-B is being given with successful results.

Herpes Zoster (KAKSAROGA) is described by Susruta as affecting the skin of the eyelid and exhibited in the form of vesicles.

Treatment:—Sedative and antiseptic ointments are indicated.

Krimi granthi (OPHTHALMOMYIASIS): Characterised by the presence of a nodule (granthi) appearing at the junction of the eyelid and the eyelashes and attended with an itching sensation. Parasites of different species infect the region where the inner lining of the eyelid is connected with the sclerotic coat of the eye and gradually invade and vitiate the tissue of the eye-ball. The treatment of Krimi-Granthi is surgical consisting in the incision (bhedana) of the Granthi (nodule) with the vrihimukha sastra. After incision the affected part should be duly fomented and treated with a chemical solution prepared by the decoction of triphala with the addition of tuttha (copper sulphate), Kasisa (ferrous sulphate) and Saindhava (sodium chloride). As a routine treatment in every case in which the bhedana (incision) operation is to be performed, the patient's system should be duly cleansed by the proper administration of emetics and purgatives.

TRICHIASIS AND DISTRICHIASIS

Trichiasis:—It is an inversion of the eye lashes. Districhiasis is an inversion of two rows of eye lashes, one is the anterior and the other is the posterior. In both these conditions the eye lashes rub against the cornea. Thus it causes irritation of the eye ball and produce the following symptoms—pain, lacrymation, photophobia, opacities and ulceration of the cornea.

The most common causes are:—(1) Sequelae of trachoma, (2) Blepharitis, (3) Burns, (4) Injuries, and (5) lid operations.

Treatment:—When one or two lashes stand incorrectly epilation of the cilia by the cilia forceps may be done and to be repeated after a week or two if they grow again.

If the misdirected lashes are too many, destruction of the follicles by Electrolysis is the best. A positive electrode is placed on the temple, while the negative electrode consisting of a platinum needle is introduced into the hair follicles. A weak galvanic current is employed. One then at once sees a fine foam appear at the root of the cilium, showing evidence of chemical decomposition of tissue fluids caused by the electric current. The procedure is quite painful and it requires an injection of Novocain 2% under the skin. Generally there will be no relapse after this. In some cases where Entropion is associated with Trichiasis operation is necessary.

ENTROPION

Entropion is the inward rolling of the lid along with the eye lashes. It is of two types spastic and cicatrical. The spastic form is due to the spasm of the palpebral portion of the orbicularis muscle. It is most common in old people who are predisposed through relaxation of palpebral skin and the deep position of the eye-ball. It occurs also in people who have atrophy or the absence of the eye-ball. Prolonged wearing of a bandage in some operative cases leads to spastic Entropion. Blepharospasm is another cause. Spastic Entropion is always found in the lower lid.

Cicatrical Entropion:—It is most common in the upper lid and is due to the following causes:

(1) Trachoma, (2) Burns, (3) Injuries, and (4) Surgical operation of the lids.

Signs and symptoms of irritation of the eye such as pain, Lacrymation, photophobia are generally present.

Ulceration of the cornea is generally seen. In chronic cases opacities develop here and there.

Treatment:—A small roll of cotton wool applied to the orbital margin of the lid and bandaged constantly for sometime will relieve the spastic condition. The lid may

be kept everted by means of an adhesive plaster passing from the margin of the lid to the cheek. In the cicatrical variety, webster's operation is the best to be adopted.

Ectropion :—It is an eversion of the lid with its conjunctival surface. It is quite opposite to Entropion. It may affect the upper or the lower lid. Due to the eversion of the lid the puncta will be exposed and thereby watering and consequent excoriation and eczema of the lower lid ensue. The conjunctiva will be hypertrophic and reddened. Ulcers or opacities of the cornea may be present owing to the incomplete closure of the eye-ball.

Causes :—(1) Cicatrical contractions from wounds, burns, ulcers of the lid margin or its surrounding surfaces, (2) Chronic conjunctivitis and Blepharitis associated with considerable hypertrophy of the conjunctiva and (3) Paralysis of the Fascial nerve and paralysis of the orbicularis muscle.

Treatment :—In spasmodic varieties of Ectropion, proper bandaging of the eye will be very useful. If Ectropion is due to fascial paralysis, Electric massage and bandaging are the best. Where there is hypertrophy along with Ectropion, Silver nitrate solution 2% should be touched over the hypertrophy. Operative treatment should be resorted to in cases of cicatrical Ectropion.

Diseases of the Paksma Mandala (Region of the Eyelashes) as described by Susruta are given below:—

Paksmakopa (Trichiasis) — an accumulation of deranged intraocular humours about the region of the eyelashes makes them rough and sharp-pointed giving rise to pain, lachrymation and photophobia. The patient gets relief, when the eyelashes are epilated. This disease is called paksmakopa by Susruta. A patient afflicted with this disease cannot bear the least wind or heat or glaze of the sun. Though Paksmakopa is generally transliterated as trichiasis, it includes the other pathologically aberrant conditions of the eyelashes, namely, districhiasis, ectropion and entropion, because paksmakopa literally means an enraged condition of the eyelashes.

Treatment of Paksma-kopa—Susruta discusses the treatment of this ocular affection under the following heads namely:—(1) Operation; (2) Cauterisation with fire; (3) cauterisation with alkali and; (4) and application of medicinal drugs.

The operative treatment of paksmakopa is described by Susruta as follows: The patient, having been previously treated with an oleaginous medicament for clearing his bowels and pacifying the deranged bodily humours, should be laid in a comfortable and convenient position. On the surface of the eyelid, the surgeon should then mark out an area lying two parts below the eyebrow and one part above the eyelashes and being uniformly parallel to the part of the eyeball lying between the mesial angle and the exterior corner of the eye. With the help of a vrddhipatra sastra (cutting knife) incisions about the dimension of a barley corn should be made in this marked-out area, which should then be carefully dissected out without causing any injury to the underlying tissues. The two edges of the incision would be duly sutured with horse hair and covered over with honey and clarified butter. The resultant wound would thereafter be treated as an ulcer. A piece of linen having been tied round the forehead, the horsehair suture should be fastened thereto. When the two edges of the wound become completely adherent, the horsehair sutures should be carefully removed by the surgeon.

If the surgical measures become unsuccessful, the surgeon would think of cauterisation of the part. For this, the eye is to be lifted in an inverted position and the diseased area carefully cauterised with fire or alkali.

If cauterisation again proves abortive and there is no relief to the patient, the paksma-mala (eyelashes) should be secured with three hooks (vadisa Jantra) and epilated at one sitting with an epilation forceps (Paksmakopa samdansa). The affected part would then be rubbed with a paste of haritaki (terminalia chebula) and tuvaraka (Symblocos Recemosa).

The above therapeutic measures are, according to Susruta, capable of curing Paksmakopa (trichiasis), but the disease being a Yapya one (admitting only of palliative treatment), the cure might be short-lasting.

In addition to the above measures, the surgeon should profitably employ purgatives, eye lotions, medicinal snuffs, fumigations, plasters and collyria in treating a case of Paksmakopa.

BLEPHAROSPASM

It is a spasm of the orbicularis muscle. It is characterised by the closure of the lids. The spasm is either tonic or clonic. The tonic form arises in cases of corneal

SUSRUTA'S PAKSMA-KOPA OPERATION

A, the first stage of Susruta's operation for *paksma-kopa (trichiasis)*. The incision (*a* and *b*) is two parts below the eyebrow and one part above the eyelashes and should be of the dimension of a barley corn. The direction of the incisions should be elliptically parallel to a line drawn from the *kaninika* (*d*, mesial angle) and the *apanga* (*c*, the exterior angle). *B*, the second stage of the operation. The elliptic piece of skin lying between the incisions has been dissected out, and the edges of the incision are sutured with horsehair (*a*, *b* and *c*). *C*, the third stage of the operation. The incised edges have been stitched with horsehair. A piece of linen (*a*) is tied round the forehead of the patient. The horsehair suture (*b*) is attached to the piece of linen.

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Acute Dacro - Cystitis

Note the marked swelling at the area of the sac

ulcer, foreign bodies in the eye, the inflammatary conditions of the eye such as Iritis, Iridocyclitis, and Fissure of External canthus. The clonic form arises in case of persons who are having refractive errors and suffering from chronic constipation. Hysteria is also one of the common causes of Blepharospasm.

Treatment :—The cause is to be removed.

Iritis or Iridocyclitis should be treated. Chronic constipation should be relieved; errors of refraction should be corrected; Hysteria should be treated by psychotherapy. Locally to relieve Blepharospasm, cold douches should be applied over the eyes or frequent instillation of cocaine into the eyes should be done. Application of galvanic current locally relieves the spasm to a great extent.

Blepharospasm (*Nimesa*) Characterised by constant spasms of the lids due to incarceration of the deranged vayu (nervous force) within the nerves controlling the eyelids.

Vata-hata-Vartma (Ptosis, paralysis of the eyelids)—Drooping (paralysis) of the eyelids, accompanied with or without pain so as to interfere with the opening of the eyelids, which seems to be out of joint.

As for the etiology of these two ocular affections, they are due to disorders of the nervous force (vayu) either local or general.

Treatment :—According to Susruta, the above two diseases are put in the category of asadhya (incurable) or Krchhra-sadhya (difficult of cure) eye diseases. For general therapy, the surgeon would adopt the measures described under the vataja abhisyanda. Emphasis should be laid however on increasing the general resistance of the patient, and remedying any constitutional diseases that may be present.

Ptosis :—Drooping of the upper lid is known is ptosis. The drooping at first may be slight and later on it may increase to such an extent that it completely covers the eye-ball and interferes with the vision. The patient in his attempt to see, raises his occipito-frontalis muscle and throws the head backward so as to favour exposure of the pupil. This attitude is characteristic of ptosis. It is either congenital or acquired. The congenital type is generally bilateral and is due to the lack of development of the levator muscle. In the acquired variety paralysis of the levator muscle or the nerve supplying it are the chief causes. It is also due to trachoma, Tumors, atrophy or absence of the globe.

Treatment:—It is not very satisfactory. Paralytic cases respond to treatment to some extent. Electric massage to the affected muscles will be of some service. Generally Pot. Iodide is given internally. If the paralysis is due to Syphilis, Anti-syphilitic treatment should be given. Tumors may be removed and an Artificial eye may be introduced if needed. For congenital variety, operation is the only course. The results of the operation are not very satisfactory.

Tumors of the Eyelids:—They are either Benign or Malignant.

Treatment:—Complete excision of the tumor is the best method. Radium and Carbondioxide snow may be applied in persistent Malignant Tumors.

INJURIES OF THE EYE LIDS

These are quite common and include contusions, burns and insect bites. The common symptoms are Ecchymosis and oedema of the lids.

Ecchymosis (Black eye) causes disfigurement. It lasts for one or two weeks. Application of cold compresses followed by hot compresses and massage will hasten the course. In the fracture of the base of the skull, Ecchymosis appears in the lower lid and in the bulbar conjunctiva. Attention should be drawn towards the causative factor and treated accordingly.

Incised, Lacerated and Contused wounds:—These are treated as usual. Stitching, if necessary, should be done in Lacerated wounds. Strict asepsis should be observed during the course of treatment.

Burns:—These are also common. Tannic acid ointment 2 % will be very useful. If the burn is deep, antiseptic dressing and if necessary skin grafting will be effective.

Insect Bites:—Application of cold compresses will relieve the Oedema.

DISEASES OF THE TEAR SAC

CHRONIC DACROCYSTITIS

Chronic Dacrocystitis or catarrh of the lacrymal sac or otherwise called Mucocele, is a chronic inflammation of the lacrymal sac. The chief cause of chronic Dacrocystitis is stricture of the nasolacrymal duct. Stagnation of the contents of duct leads to inflammation of the tear sac. Inflammation of the nasal mucous membrane or Tumors obstructing the

opening of the duct such as Nasal polypi, or injuries of the nose etc. are the chief causes of narrowing of the naso-lacrymal duct.

Symptoms:—The common symptom is the frequent watering of the eye which will be increased by exposure to cold, wind and dust etc. There is a fullness in the region of the lacrymal sac and if pressed over it pus or mucopurulent fluid escapes through the puncta or through the nose.

The disease is always chronic. Owing to the constant epiphora, chronic Blepharitis or chronic conjunctivitis often accompany the disease.

The treatment is Medical and surgical. The causative factor should be attended to at first. Any Nasal abnormality should be treated. The tear sac should be daily emptied by pressing over the area of the sac and irrigated with a special syringe (Anel's). The solutions that are generally used are, sublimate solution 1 in 4000, 3 % Boric solution or protorgal. In the later stages these solutions can be replaced by astringent solutions like Zinc. If the above measures fail and if the canal is narrow and presents strictures, gradual probing should be done. This is done with the help of Bowman's probes.

When the obstruction is absolute, probing is useless and complete removal of the lacrymal sac is indicated.

ACUTE DACRO-CYSTITIS

It is an acute inflammation of the lacrymal sac occurring in the course of a chronic Dacrocystitis, as a result of an acute exacerbation. It may lead to a lacrymal Fistula.

Streptococcus or pneumococcus are the chief organisms which excite the inflammation.

Signs and Symptoms:—In the region of the tear sac, the skin is reddened and swollen. The swelling extends on to the lids and even to the conjunctiva. Fever and severe pain accompany inflammation so that the patient is generally devoid of sleep both day and night. After a few days, the skin over the top of the swelling becomes yellowish and finally breaks, emptying large amount of pus. Thereupon the pain and swelling subside. The perforated opening at first discharges pus, then mucopurulent and then a clear watery fluid, resulting in fistula of the tear sac. As long as the fistula lasts the patient is sure to get a renewed inflammation.

Treatment:—If the abscess is fluctuating it should be incised in the middle and the whole pus is let out. Idoform gauze is packed daily into the wound till the closing of the fistula. One may encourage the closure of the fistula by freshening up the wound and closing it by sutures or by a cautery. When the inflammation subsides probing may be resorted to or if the patient refuses to undergo the long course of probing excision of the sac should be done.

Diseases of the tear sac (Ancient):—Puyalasa (acute dacrocystitis)—an inflammatory swelling at the sandhi (Junction) of the Kaninika (mesial angle of the eye) from which exudes fetid and dens pus.

Signs and Symptoms:—Severe pain, fever, sleeplessness, the skin near the tear sac becomes reddened and swollen. The inflammatory swelling ultimately suppurates.

Treatment:—Both surgical and medical. Blood-letting, after the application of sneha (oleoginous medicament followed by sveda (compresses) and upanaha (poultices), aschyotana, and irrigation of the sac with antiseptic and antiphlogistic lotions.

The following anjanas are very useful in puyalasa—Kasisa (ferrous sulphate), saindhava and juice of ginger should be pasted together; or ferrous sulphate, sodium chloride should be compounded with powdered copper and iron and pasted with honey, should be used as an anjana.

Susruta described the following four kinds of Sravas (lacrimal fistulæ)—diseases of the lacrimal ducts give rise to profuse discharge. These ducts end in fistulæ and produce secretion.

Puya-srava (lacrimal fistula with a purulent discharge)—A suppuration in any of the sandhis (Junctions) of the eye characterised by discharge of pus.

Slesma-Srava (lacrimal fistula with lymphatic exudation)—The secretion of slimy, white, thick mucopurulent discharge marked by the absence of pain is called slesma-Srava.

Rakta-Srava:—A flow of thin, warm and blood streaked copious discharge due to a contaminated state of the local blood is called rakta-Srava.

Pitta-Srava:—Characterised by a warm and yellowish discharge from the middle part of the sandhi (Junction) due to the derangement of the biliary junction.

Treatment:—Medical and Surgical; prognosis unsatisfactory.

EYE DISEASES DUE TO IMPROPER DIET

This chapter not only includes diseases resulting from deficiency of Vitamins but also due to excessive indulgence of fat, carbohydrates and nitrogenous foods. Improper diet gives rise to the following ocular affections:—

The deficiency of Vitamin 'A' gives rise to the following:—

1. Xerosis of the conjunctiva and cornea.
2. Night blindness.
3. Keratomalacia.

The deficiency of Vitamin 'B' gives rise to the following:—

1. Epidemic dropsy-Glaucoma;
2. Pellagra—with its eye complications; and
3. Beri-beri and its eye complications.

The deficiency of Vitamin 'C' gives rise to

1. Scurvey or Rickets with its ocular complications.

The Deficiency of Vitamin 'D' causes.

Rickets with its ocular affections.

Excess of Carbohydrate results in:—

1. Diabetes with its ocular complications; and
2. Phlyctenular ulcers.

The excess of Nitrogenous food gives rise to:—

1. Rheumatism; and
2. Gout with their ocular affections.

XEROPHTHALMIA

Xerophthalmia has been described long ago in Papirus of Eber. From that date very many authors namely Mecallum, Olaf Blegvad, McCarrison, Pillat of China, Kirwan of Calcutta, Wright of Madras have done extensive research work on this subject.

It is a disease of the poor and is mostly common in poor countries like India, China, Japan, Egypt etc. The disease is generally common in young children and specially in those who are weak and debilitated but it is less common in adults. Trachoma, burns, pemphigus and constant

exposure of the eyes as a result of Exophthalmus, Lagophthalmus are the common local factors that give rise to the disease. Deficiency of Vitamin 'A' in the food is said to be the general factor. Extensive research work was done in this connection and came to the conclusion that xerosis may arise as a result of complete absence of vitamin 'A' or deficiency of vitamin 'A' in the diet or poor absorption of vitamin 'A' resulting from gastro-intestinal disorders.

Signs and Symptoms:—Xerophthalmia is characterized by lustreless condition of the conjunctiva with Bitot's spots, pigmentation and wrinkling of the conjunctiva, night blindness and in bad cases drying up of the cornea with infiltration and necrosis.

The disease at first starts with the loss of lustre of the bulber conjunctiva. This is well seen when the eyes are kept open for a few seconds without winking. Generally night blindness often starts at this stage or even earlier. The wrinkling of the conjunctiva is also an early symptom. Pigmentation is seen in all regions except in the superior fornix. It is light brown in colour. The colour varies with individuals. Within a short time the lustreless condition of the conjunctiva becomes much more evident and exhibits white foamy patches, known, as Bitot's spots. These spots lie on the temporal side of the palpebral fissure and less on the other side. These are generally triangular in shape. The tears do not adhere to these spots.

Sometimes irregular patches occupying a part of the whole of the bulbar conjunctiva and sometimes even overlapsing the limbus, are observed. But these are rare. The shape is very irregular.

The sensibility of the conjunctiva in all these cases is more or less decreased. There is a slight degree of injection of the bulbar conjunctiva with slight secretion.

Xerosis Cornea:—Xerosis of the cornea is either an independent affection or a further extension of Xerosis conjunctiva. Before the actual Xerotic patches are evident there will be a slight loss of lustre of the cornea. Sensibility of the cornea is reduced.

Later on, actual Xerotic patches appear on the cornea. They may be present either at the limbus, being continuous with that of xerosis of the conjunctiva, or isolated patches situated in the cornea unconnected with the limbus. Later on, if the condition is untreated infiltration and necrosis

of the cornea takes place, resulting in the complete distruction of the whole eye. In the ophthalmoscopic picture, no abnormality is seen except a slight paleness of the Retina. This condition often associates itself with night blindness and disappears when night blindness disappears.

Prognosis :—It is good in early and in conjunctival xerosis but it is grave in corneal xerosis and in advanced cases.

Treatment :—General and Local.

The treatment is more general than local. Large quantities of foods containing vitamin 'A' such as milk, ghee, fruit, cod-liver oil, vegetables and eggs should be given. Vitamin 'A' in the form of injection is also advised when there is the gastro-intestinal disorder.

Local :—The eyes is to be irrigated daily with Boric lotion and a mild Boric ointment is to be applied. If there is light congestion with discharge, the conjunctiva is to be touched with Silver Nitrate 1%. If cornea is affected atropine drops should be put into the eyes. Anti-xerophthalmic ointment, consisting of Halibut liver oil is tried with success.

NIGHT BLINDNESS

It may occur independent of xerosis or keratomalacia. There may or may not be any changes in the fundus. These are generally due to 'A' avitaminosis. So they generally improve with food, containing vitamin 'A' such as Cod-Liver oil, Liver extract, green vegetables, milk, butter, ghee, etc.

* Keratomalacia

BY

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Keratomalacia (Keras-Horn, Malakos-Soft), softening of the Cornea, is the ultimate result of a nutritional deficiency disease occurring mostly in children, and less commonly in adults. The title is used in its widest sense to include all the manifestations of deficiency of the Fat-Soluble Vitamin A. It is one of the most devastating diseases in children in Malabar. Keratomalacia destroys many infantile eyes and lives and a few adult eyes every year in Malabar. Fortunately, ophthalmia neonatorum is very rare in these parts. Ophthalmia Neonatorum is as frequent in Western Europe as Keratomalacia is in certain parts of India. Keratomalacia is almost as prevalent as Trachoma in these parts.

SIGNS AND SYMPTOMS

1. One of the earliest signs to appear is *Xerophthalmus Epithelialis*, a dry, white, foam-like patch, on the bulbar conjunctiva, in the palpebral fissure. These occur as Bitot's spot, a triangular patch of epithelial Xerosis with its base towards the limbus on the bulbar conjunctiva in the palpebral fissure, on one or either side of the Cornea; or as smaller or larger irregular white patches scattered on the conjunctiva. One or more of these patches are frequently seen often in both eyes, less frequently a unilateral lesion is also found. Epithelial Xerosis affects the cornea rather very late in the disease. The earliest symptom is the lost of lustre, and the loss of sensibility of the cornea. The irregular white plaques of various sizes appear scattered in the centre, or periphery of the Cornea. The whole cornea may soften by degeneration, or disintegration beginning in the superficial layer and later affecting the whole thickness. This condition is known as Keratomalacia. Xerosis Bacilli are found in the epithelial debris of the cornea and conjunctiva. Pigmentary changes from brown, to dark discoloration of the conjunctiva, especially in the caruncle, as also scattered in other parts of the conjunctiva, are seen early in the disease. Wringling of the conjunctiva, especially noted in moving the eyes side to side, when the palpebral fissure is wide opened with the finger and thumb, is due to a loss of elasticity in the deeper layers of the

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conjunctiva. Diminution or loss of lachrymation also occurs early in the disease, causing a peculiar dryness of the conjunctiva.

2. *Night Blindness*:—Hemeralopia, of continental authors, and Nyctalopia, of English authors, is the inability to see in the dark especially after sunset. During the day the vision is clear. But at night, or in a dark room, even with artificial light, the vision is lost. The patients are unable to walk, read, or write, or see objects in front of them after sunset. There are no ophthalmoscopic changes in the eyes. This inability to see at night without any obvious lesion in the fundus of the eye is known as *Essential Night Blindness*. It is due to a disturbance in the regeneration of the visual purple contained in the outer end of rods in the Retina.

3. *Skin Eruptions*:—Small, hard, dark, sharp pointed, epidermal papules on the skin of the limbs, buttocks, chest, back, and abdomen are very characteristic of nutritional deficiency. These skin eruptions are generally accompanied by either night blindness, or Xerophthalmus epithelialis, or by both. It might occur alone as an early symptom of deficiency of the Fat-Soluble Vitamin A. This hyperkeratinisation of the epidermal epithelium is known as Lichen spinosum or phranoderma, and is similar in appearance as Pityriasis rubra pilaris, and Lichen ruber acuminatus. Like Xerophthalmus epithelialis of the conjunctiva, and Cornea, this also is due to an epithelial disturbance caused by the Fat-Soluble Vitamin A deficiency. It is remarkable to note that these symptoms of epithelial Xerosis (called in Malayalam as Ithel = line in the eye), night blindness (in Malayalam Rakurudu or Malakannu) and lichen spinosum (in Malayalam Kara), were recognised in Malabar from very ancient times by Ayurvedic Physicians, occurring singly or in combination as symptoms associated with nutritional deficiency, and were effectively treated by the administration of chicken soup, black chicken cakes, and medicated cow's and goat's milk, butter and ghee. It is interesting to know that our ancients discovered the nature, probable cause, and treatment of this disease without the facilities of the modern research worker with his costly experiments on rats, mice, and other animals.

4. *Diarrhœa, and Gastro-intestinal disturbances are common occurrences in Keratomalacia*:—Diarrhœa is a very disturbing condition to deal with in Keratomalacia, especially as the oral administration of nutritional diet is made difficult. Diarrhœa, if not tackled carefully in the

early stages, leads to emaciation, anæmia, dropsy, and finally marasmus, and death. Here also the mucous membrane of the Gastro-Intestinal tract is affected, showing that the disturbance in the epithelial cells is brought about by the Vitamin A deficiency more than the deficiency of other nutritive factors in the diet.

5. The epithelium of the respiratory tract also gets affected in Keratomalacia as shown in the early occurrences of Catarrh of the mucous membrane of the Nose, Pharynx, Larynx, Trachea, Bronchi, and Bronchioles leading to capillary Bronchitis, and Bronchopneumonia which may end fatally.

6. In Keratomalacia it is significant to note that the eyes are free from the disturbing symptoms of pain, lachrymation, photophobia, redness and chemosis which are most prominent symptoms of other acute affections of the eye.

COURSE

It is convenient to describe the course of the disease in three stages.

1st stage:—Epithelial Xerosis or discoloration, and pigmentation of the Conjunctiva may be the earliest symptoms to appear. Conjunctival lesions may be accompanied by night blindness, or skin eruptions. Night blindness or Skin eruptions may be the earliest symptoms to appear. Either of these may be followed by the other and also by Conjunctival Xerosis. If any of these symptoms are detected and treated early, the disease is cured without the occurrence of later symptoms.

2nd stage:—If untreated, the epitheial Xerosis of the Cornea will begin manifesting itself by slight loss of lustre of the Cornea, and loss of sensibility of the Cornea, developing into the appearance of irregular white patches scattered in the centre, or the periphery of the Cornea. Treatment of this early Corneal lesions also is attended with good result.

3rd stage:—If not treated properly, degeneration, disintegration and desquamation of the entire Corneal epithelium takes place; and this is the condition to which the name Keratomalacia has been originally applied. Keratomalacia of the entire Cornea very seldom yields to treatment but results in the entire peeling of the whole Cornea with anterior staphyloma of the Iris, or in the loss of the whole thickness of portions of the Cornea with prolapsed Iris, resulting in adherent leucoma, or Staphyloma Cornea.

Pyogenic infection of the Cornea may set in, causing severe ulcers of the Cornea with hypopyon. Perforation of ulcer with prolapsed Iris results in adherent Leucoma or Staphyloma Cornea, with partial or entire loss of vision. Secondary glaucoma is quite usual in these eyes with the result that the Staphyloma attains an enormous size that it bulges outside the Palpebral fissure giving rise to considerable discomfort and ugliness to the patient.

Diarrhoea, which occurs during any of the three stages in the course of the illness, if not properly controlled and cured, leads to emaciation, anaemia, dropsy, and marasmus, with a fatal termination.

Bronchitis and Broncho-pneumonia also occurring during any of the three states in the course of the disease, if severe and if the patient is emaciated, will also end fatally.

AGE AND SEX INCIDENCE

Infants in their first two years of life are the greatest number of sufferers. The percentage diminishes as age advances. The number of sufferers between 2 and 6 are less than before that age, also still less between 6 and 14. Adults are not free from the disease, but are very much less frequently attacked than children. In my experience in children, the disease is almost equal in both sexes; but in adults the female sufferers are about 3 times as many as the males. Females, during pregnancy and lactation, have a great susceptibility for the disease. I get many cases of this type every year at my clinic, most of them too far advanced to do any good by treatment.

Although poverty is undoubtedly the cause of Malnutrition and the largest number of victims are found amongst underfed children, and women of the poor, the rich cannot be entirely excluded. I have had Karatomalacia amongst the rich Namboothiris, the Zamindars of Malabar.

Aetiology:—It is proved beyond doubt by research workers by experiments on animals, and by clinicians that Keratomalacia is caused by the deficiency in the diet of the fat-soluble Vitamin A. Vitamin A deficiency has been proved to cause characteristic abnormality in the mucous membrane cells and the nerve cells. It is significant to note that in Keratomalacia, the epithelial cells of the Conjunctiva, the Cornea, the Epidermis, the mucous membrane of the Gastro-intestinal tract, and the respiratory tract are affected.

There are certainly other contributory causes. The deficiency of other Vitamins and active factors in the diet may help the disease, Intestinal parasites, especially round worm and hook worm, by their deleterious effect on the patient, undoubtedly help the disease. So also dysentery, both amoebic, and bacillary. Similarly other debilitating diseases also help the disease. In Malabar especially in children round worm and dysentery have been frequently associated with Keratomalacia.

Treatment:—Early recognition of the disease and early treatment is attended with complete success. General Practitioners in cities, towns, and rural districts, are the first to come across these cases. They will be consulted for the diarrhoea, the skin eruptions, the night blindness, or the Xerotic patches in the Conjunctiva, the Catarrh of the nose, or the respiratory tract.

An adequate supply of Vitamin A in the food is the principal treatment of the disease. Pure Cod Liver Oil is the cheapest, and the best for administration by mouth, or in severe cases of diarrhoea, it may be rubbed on to the axillary, or abdominal skin. Concentrated forms of Cod Liver Oil, and Halibut Liver Oil containing Vitamins A and D of various concentrations are available in the market for oral administration. Concentrated preparations of Vitamin A are available for injections also. Healthy mother's milk contains all the Vitamin A necessary for the infant. Nursing mother should be given pure Cod Liver Oil, Milk, butter, ghee and green Vegetables in abundance.

Children left off the breast should have an abundance of goat's milk, cow's milk, butter, and ghee mixed with a sufficient quantity of Cod Liver Oil, Green Vegetables as Carrots are also useful.

Intestinal parasites should be got rid off at the beginning of the treatment by giving Santonine, Oleum Chenapodium for round worms, Carbon tetrachloride for the hook worm. I have a child 2 years and 2 months old just now under my treatment with Keratomalacia of the 2nd and early 4th stage with diarrhoea, and slight fever. Parents told me that the child has passed over 50 worms under Homeopathic treatment. Santonine followed by an emulsion of castor oil and Oleum Chenapodium was administered by me the first day the child was brought to me and the child passed over one hundred and eighty round worms, and the diarrhoea stopped immediately. With the continuation of Syrup Ferri Iodide m. xv. and Adexolin m. xv.

thrice daily in milk, and the routine treatment for the eye, the child is improving rapidly.

Dysentery also should get treatment from the beginning, if amoebic, Emitine, and if bacillary, serum, should be injected.

Local treatment for the eye lesions in the 1st stage is not required, and in the 2nd stage mild antiseptic lotions, and Argyrol 5 % solutions for washing, and instillation are all that is required. In Corneal affections in infants, and young children, Eserine $\frac{1}{4}$th to $\frac{1}{2}$% instillation is preferable to Atropine 1% which is used in older children and adults,

EYE DISEASES DUE TO VITAMIN B DEFICIENC Y

Beri-beri:—It is due to deficiency of vitamin 'B' in the diet.

The common eye complications are Retrobulbar neuritis and sometimes pallor of the disk and paresis of the eye muscles. These symptoms and signs disappear when the general condition improves.

Treatment:—Give large quantities of Vitamin 'B' food such as peas, beans, lentils, cereals, yeast and maramite. Avoid eating boiled polished rice which is completely devoid of vitamin 'B'. Inject Betaxin or any other vitamin B product.

Epidemic Dropsy:—Glaucoma is the common complication. Very many cases are being seen in the province of Bengal.

PELLAGRA

This is also due to 'B' avitaminosis. These cases are prevalent in U. S. A., Italy, Rumania, etc.

Treatment:—The most common eye complications are amblyopia, night blindness, optic atrophy, cataract and porptosis etc.

Treatment:—Maize should be omitted in the diet and large quantities of vitamin 'B' foods should be given internally.

EYE DISEASES DUE TO VITAMIN C DEFICIENCY

Scurvey and Rickets:—These are due to deficiency of vitamin 'C' in the diet. The ocular complications are Haemorrhages in the orbit resulting in proptosis of the eye ball. Night blindness is also one of the common symptoms.

Treatment:—Foods containing vitamin 'C' such as Lemon Juice, Tomatos etc. should be given internally.

EYE DISEASES DUE TO VITAMIN D DEFICIENCY

Rickets :—It is due to deficiency of vitamin 'D' in the food. The common ocular complication is Zonular cataract.

Treatment :—When the cataract has already been formed, nothing can be done except needling, linear extraction. The general health should be improved by giving internally Cod-liver oil, calcium foods and ultra violet rays exposure.

PHLYCTENULAR ULCERS OF THE CORNEA AND CONJUNCTIVA

These are said to be due to excessive in take of carbo-hydrates combined with local infection and Tubercular diathesis.

Treatment :—Reduction of Carbo-hydrate in the diet along with local treatment will cut short the disease to a great extent.

Gout :—This is due to excessive ingestion of Nitrogenous foods. The common ocular complications are—conjunctivitis, keratitis, scleritis, iritis, cyclitis, glaucoma, etc.

Treatment :—Highly nitrogenous food should be avoided. Alcohol should be stopped. Meals should be reduced. Fresh vegetables and fruits should be given in large quantities.

Pot. Citras with T. Colchium is the usual medicinal treatment. Regular baths and exercises will be very useful.

Rheumatism :—It is also due to excessive in take of Nitrogenous foods.

Iritis, conjunctivitis, scleritis, are the chief ocular complications. Paralysis of the ocular muscles is rare.

Treatment :—Salicylates, Pot. Iodide internally with local treatment will cut short the disease to a great extent. Milk injections are said to be very useful in these cases.

Large quantities of fruits, vegetables should be given internally.

Eye Diseases Due to Improper diet (*Ancient*) :—From the writing of Susruta on Ocular Therapeutics it is amply clear that he knew the importance of the essential food factors (now known as vitamins) in the maintenance of health and proper nutrition of the ocular structures, he therefore freely prescribed vitamin therapy in the shape of vitaminous food-stuffs, such as milk, butter, cream, old ghrta, medicated milk, sugarcane juice, liver and liver extracts, lemons, oranges, Green vegetables such as Agati flowers and leaves (Agati Grandhiflora) etc.

Kapha-vidagdhadrusti (Night-blindness)—Susruta's principles of treatment for this ocular affection are :—Vitamain therapy

in the administration of liver and liver extract, butter, milk, ghrta (clarified butter) green vegetables such as the flowers and leaves of Agasti (Agati grandhiflora),

Susruta was the first surgeon ophthalmologist to introduce the eating of cooked liver in night blindness. Local application of liver extract ointment is also advocated. The prognosis of this disease is good.

The fat and liver of a goat together with a quantity of clarified butter skimmed out of the milk of a she-goat mixed with pippali and saindhava should be cooked with the expressed juice of Amalaka (Embelica Officinalis). The preparation would then be admixed with honey and preserved in a closed vessel made of catechu wood. The use of this compound as an anjana is very efficacious in night blindness.

Harenu (Piper auranticum), pippali seeds (without pericarps), Ela(cardamom) and the liver of a goat all these to be taken internally or an anjana prepared by compounding the above with the juice of cow-dung.

The liver of a godha (a kind of lizard) is to be partially opened and stuffed with pippali and then properly roasted in fire. The use of this compound for only once as an anjana prepared with honey would be found to be highly efficacious in night-blindness.

The liver and spleen of a goat or of a godha (lizard) would be cut into pieces, mixed with oil and clarified butter and roasted on a fire. Used internally or as an anjana with mustard oil, it would speedily cure an attack of night blindness.

A single application of an anjana prepared from goat's liver stuffed with pippali and roasted in fire would certainly cure a case of night-blindness.

A varti-anjana (medicinal stick) composed of sauviranjana (antimony sulphide), saindhava and pippali (Piper longum) and Renuka (Piper auranticum) pasted together with urine of a she-goat would prove highly beneficial in a case of nocturnal blindness.

The other deficiency ocular diseases which Susruta described are Xerophthalmia, Xerosis conjunctiva (Pariklinna-Vartma) and Vaihayasabhra Sukra (kerato-malacia). The treatment consists in looking after the nutrition of the patient through a strengthening and vitaminous diet, such as milk, butter, green vegetables and ghrta (clarified butter). The prognosis of these ocular affections is good only when they are early treated.

Ocular Complications in Diabetes Mellitus

BY

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In no other metabolic disease, the ocular complications are so evident and so numerous as in Diabetes Mellitus. In fact some of the ocular signs and symptoms are so prominent and so significant in this disease, that these alone may be sufficient in its diagnosis. The statistics of the European and the American countries show that about 20% to 30% cases of Diabetic patients have ocular complications; in our country, the percentage of cases of Diabetes Mellitus with ocular affections are perhaps somewhat higher because a large number of Diabetic patients in our country are left undiagnosed and untreated.

How ocular tissues are affected in Diabetes Mellitus?

Diabetes Mellitus is a disease which is produced by failure of normal metabolism of sugar. This failure of sugar metabolism leads to the increase of blood sugar concentration or a state of 'hyperglycæmia' is produced. Firstly, this hyperglycæmia probably acts as a toxin and damages the various parts of ocular tissue. Secondly, the normal metabolism of the eye is disturbed owing to the altered composition of the blood which also circulates in the orbit. Lastly, the vascular changes in the brain which are produced in this disease, may secondarily affect some parts of the eye.

Which parts of the eye are affected in this disease?

Practically every part of the eye may be affected from this disease.

The more common affections are in:—

1. Lens. 2. Retina. 3. Ocular muscles.
4. Optic tract. 5. Iris. 6. Ciliary Body.

The less common affections are:— in

7. Cornea. 8. Sclera.
9. Intraocular Fluid. 10. Conjunctiva.
11. Vascular changes in the brain causing ocular symptoms.

1. Lens.

(*a*) Changes in the refraction of the lens. This is mostly due to the swelling of the lens in the first stage of diabetic cataract. As a result of swelling of the lens the refractive error is in the direction of myopia.

(*a*) *Cataract.*

This is the most common complication of eye in diabetic patients. Cataract in a rather young patient, as below 40 years of age, especially when bilateral should arouse suspicion of diabetic origin.

What are the characteristics of diabetic cataract?

(*a*) It begins with the formation of milky spots behind the capsule of the lens, especially in the posterior pole.

(*b*) There is often the association of the swelling up of the cells of the iris from which in many cases the pigments have been lost.

(*c*) It affects both eyes simultaneously.

(*d*) It may grow very quickly, especially in young individuals; such a short period as only 24 hours may be sufficient for the complete maturing of the cataract.

(*e*) One of the characteristic symptoms in the beginning of diabetic cataract is the refraction anomaly, especially myopia.

What is the pathology of diabetic cataract?

Its pathology is not yet fully known. Probably the toxic metabolic product of the disturbed intra-ocular fluid damages at first the epithelium of the lens, which in the histological preparations, shows great damage and is very similar to those found in the toxic cataract from Napthaline poisoning.

2. *Retina.*

(*a*) Retinitis.

It is a very serious sign of diabetes. A diabetic patient with retinitis has his span of life for a few years only. About 60% are said to live for not more than 2 years.

What are the characteristics of diabetic retinitis?

(i) The presence of irregular, small white bright spots around the macula.

(ii) It occurs in both eyes.

(iii) Haemorrhages and white degenerative spots in the posterior pole may be present.

(iv) The presence of œdematous condition of the whole retina.

What is the distinction between Diabetic Retinitis and Albuminuric Retinitis?

In diabetic retinitis.	*In albuminuric retinits.*
(i) Spots around macula:— Irregular, small and bright white.	(i) Spots around macula:— Brilliant white, and have a characteristic stellate arrangement forming a star-shaped figure around the macula. Earlier deposits are cloudy and look like "cotton-wool" patches.
(ii) No changes in optic disc.	(ii) Changes in optic disc may be present.

N. B.—Albuminuria is frequently associated with diabetes as one of its complications in its later stage and so sometimes all the characteristic signs of albuminuric retinitis may be present in some diabetic patients.

(*b*) *Lipœmia Retinalis.*

The picture of the fundus is very characteristic. The retinal vessels containing lipaemic fluid look milky white. The arteries are of pale red colour and the veins have bright violet tint.

Lipaemia Retinalis denotes a very grave significance. It is often found in cases where diabetic coma has set in; it is frequently found in young diabetic patients. The examination of the fundus therefore may often be helpful in the diagnosis of comas of doubtful origin.

(*c*) *Retinal Hæmorrhage.*

It is usually of a recurrent nature and frequently associated with retinitis. A sudden obscuration of vision may result from such haemorrhages. Retinal haemorrhage is not very common in diabetes.

3. Ocular muscles.

Partial or complete paralysis of external ocular muscles are sometimes seen to take place in diabetes mellitus. As a result of such paralysis, limitation of movement, deviation squint, and diplopia, all of which increase in the direction of the affected muscle. In addition, false projection, unsteady gait, nausea, and head tilting may be present. The paralysis of muscles are due to paralysis of the nerves supplying them. The 6th nerve is affected most and next to it is the 3rd nerve. Isolated paralysis of the 4th nerve is also seen.

In rare cases, paralysis of accommodation and the loss of pupillary reflex may take place owing to paralysis of the sphincter pupillæ and the ciliary muscles.

In very rare cases, paralysis of both the extrinsic and the intrinsic muscles may take place resulting in a condition called "Ophthalmoplagia totalis".

4. *Optic tract.*

(*a*) Retrobulbar Neuritis.

The condition is diagnosed by taking the field of vision, when a central scotoma or less commonly a para-central or a ring scotoma may be found. The patient may also complain of seeing such scotomata. The diagnosis can also be made by seeing the reaction of pupil to light; when light is thrown on the affected eye, the pupil contracts at first but slowly dilates afterwards when the light is still kept on the eye. The prognosis in regard to vision is good if the condition is diagnosed early and proper treatment carried out.

(*b*) Lesion in the optic tract.

The characteristic symptom of the lesion of the optic tract is hemianopia or loss of vision in one half of the field of vision. The commonest form is homonymious hemianopia, where the right or the left half of the binocular field of vision is lost. The condition can also be diagnosed by the reaction of pupil to light, known as the "Wernick's hemianopic pupil reaction". When light is thrown on the two sides of the pupil, one side contracts properly while the other side contracts either sluggishly or not at all, showing that the afferent pupillary constrictor fibres, which undergo partial decussation at the optic chiasma, have been affected on one side due to lesion of the tract, the type of hemianopia depending on the site of the lesion.

Lesion in the optic tract is due to arteriosclerotic vascular changes of the blood vessels of the tract.

5. *Iris.*

(*a*) Iritis.

What is the characteristic of diabetic iritis?

1. Presence of plastic exudates and occasionally a hypopyon in the anterior chamber.
2. Presence of new or enlarged vessels in the iris.
3. The iritis is usually of a chronic type.

(*b*) Deposit of iris pigments in the anterior chamber.

Pigments from the stroma of the iris cells may be deposited in the anterior chamber. After the extraction of diabetic cataract, such pigments are often seen in the anterior chamber.

6. *Ciliary body.*

(*a*) Cyclitis.

The inflammatory changes from the iris may extend to the ciliary body.

(*b*) Paresis or paralysis of accommodation.

Such a condition may result from the partial or total loss of the tone of the ciliary muscle.

The patient, who probably already a presbyope, complains that his glasses no longer suit his eye for near work. Very high plus glasses, usually much higher than those necessary for the presbyopic correction for his age, may be necessary. After treatment with insulin, this symptom gradually disappears.

7. *Cornea.*

(*a*) Epithelial dystrophy of cornea.

In rare cases, there may be swelling up of the epithelial cells of the cornea and formation of vesicles; anaesthesia of the cornea may be present.

The condition generally clears up by proper treatment of diabetes with insulin.

(*b*) Pigmentation of the cornea.

There may be presence of pigmentation on the inner surface of the cornea, which has a characteristic vertical spindle shaped arrangement called the 'Krukenberg's Spindle'. This vertical spindle shaped arrangement is thought to be due to the disturbance of the aqueous humour as a result of of Diabetes.

(*c*) Sclerosing keratitis.

Sclerosing keratitis may rarely occur as a complication in diabetes. It is owing to the extension of scleritis from the sclera to the cornea.

8. *Sclera.*

Relapsing Scleritis and episcleritis may occur as rare complications of the eye in diabetes.

9. Intraocular fluid.

(*a*) Refractive changes.

Owing to the increase of blood sugar concentration, there is increase of sugar in the intraocular fluid; this causes some change in the refractive power of the intraocular fluid. This change is in the direction of myopia. It should be the duty of the physician to examine the urine of a comparatively elderly patient who suddenly becomes myopic. The patient who had been using reading glasses previously, finds difficulty with his old glasses and prefers to have either a weaker pair or no glasses at all. In such a case, glasses should not be ordered immediately, but first the urine should be examined and if the diagnosis of diabetes is made, glasses may be ordered only after 2 or 3 weeks of the commencement of the treatment of the disease.

It should also be remembered that myopic changes may also be due to the beginning of the swelling of the lens, in the early stages of diabetic cataract or in simple senile cataract.

In diabetic patients the refractive changes of the eye may also be hypermetropic. According to Duke-elder, a rise of blood sugar produces myopia and a fall, of hypermetropia, through alteration in the crystalline concentration of the intraocular fluids. Since insulin readily alters the concentration of sugar in the blood, such a disturbance has been thought to be due to the introduction of insulin.

(*b*) Hæmorrhages in the Vitreous.

These hæmorrhages are not common. These are usually of a recurrent nature and frequently associated with retinitis.

(*c*) Tension of the eyeball.

(i) Increase of.

Secondary glaucoma may be produced either as a sequelae of advanced iritis or as a result of severe retinal haemorrhages.

(ii) Reduction of tension in diabetic coma.

Reduction of tension or Krause's sign is a very important sign in the diagnosis of diabetic coma The tension of the eyeball becomes so low that even palpation with the finger should enable the physician to diagnose the condition. In comatose patients, therefore, where the cause of coma

is not known before, one should not forget to palpate the eyeball to see if it is not of diabetic origin. It is very important for the physician to diagnose this coma, because the patient can be saved by injection of insulin (a minimum of 200 units), unless the case is a moribund one. It is also of practical importance to bear in mind that coma may be brought about by hypoglycaemia in diabetic patients due to the, over dose of insulin. In diabetic coma, however, Krauses sign and the smell of acetone in the breath will be present while there will be absence of planter response. In hypoglycaemic coma, on the other hand, Krause's sign and the smell of acetone in the breath will be absent, while there will be presence of planter response. Krause's sign may sometimes be absent or difficult to detect in diabetic coma of short duration. In doubtful cases of comas of non-diabetic origin, diabetic origin may be excluded by examination of the fundus with the ophthalmoscope and the examination of the urine after taking with a catheter.

10. Conjunctiva.

The only affection of the conjunctiva in diabetes is hyperaemic changes, There may be considerable enlargement of the venous branch of the capillaries.

11. Vascular changes in the brain causing ocular symptoms.

There may be arteriosclerotic changes in the retinal vessels and thrombosis of the retinal veins causing symptoms of partial or complete blindness.

Vascular changes in any part of the visual tract from the occipital lobe to the optic chiasma may cause ocular symptoms, which has already been described.

TUBERCULOUS AFFECTIONS OF THE EYE

BY

Dr. N. K. BIDYADHAR, M.B., B.S. (PAT.)

Very much like the other systems of the body, the eye is susceptible to tuberculous infection. The incidence of ocular tuberculosis, however, is very uncommon. Tuberculosis of the eye is manifested in the following clinical conditions, namely, blepharitis, conjunctivitis, kerato conjunctivitis, keratitis, scleritis, iritis and uveitis.

Tuberculous involvement of the eye accounts for a fair percentage of the incidence of blindness.

Tuberculosis of the lid and Conjunctiva:—Tuberculous involvement of the eyelid occurs in the form of blepharitis. This form of affection occurs mostly in debilitated children and young people.

Tuberculosis of the conjunctiva is usually manifested in the form of ulcers. Ulceration of the conjunctiva may be either a tubercular or a syphilitic lesion or it may be due to the irritation caused by the embedding of a foreign body.

Tubercular manifestations of the conjunctiva may be detected in the shape of small miliary ulcerations on the palpebral conjunctiva or as grayish red granules on the palpebral conjunctiva stimulating trachomatous follicles. They may appear as irregular tubercular nodules or as gelatinous cockscomb-like proliferations or excrescences on the conjunctiva or as polypoid pedunculated tubercule nodules.

The ulcers are very indolent in nature, showing a marked tendency to spread out, though very slowly. The preauricular glands are usually enlarged, and may occasionally also suppurate. The disease takes a chronic course, appearing almost exclusively in young individuals. The ulcers may spread over on to the bulbar conjunctiva in chronic cases, the inflammatory symptoms involving the cornea which may at times be screened over by a pannus-like vascularisation.

The disease is genenerally unilateral, though in severe cases and in scrofulous children it may be manifested bilaterally. Very little pain or irritation or marked discomfort is felt by the patient except when the ulceration is very extensive in which case he is disturbed by the

induration and swelling of the eyelid and the suppurative secretion. In the latter stages the patient may suffer from visual disturbances when the cornea and other intraocular structures would be involved, resulting in Kerato-conjunctivitis, Kerato-iritis, etc.

Etiology :—Tuberculosis of the conjunctiva may arise from ectogenous and endogenous infections; it may be primary or secondary in nature. One generally suspects of ectogenous infection, when clinical evidence of tubercular infection in the system is absent. When of ectogenous origin, the tubercular lesion forms the original seat of tubercle—primary tuberculosis of the conjunctiva—the bacilli being somehow inoculated into minute conjunctival abrasions caused by exposure to dust.

The conjunctiva may equally be affected by extension of lupus from the face. Tuberculosis and lupus of the conjunctiva are identical in their characteristics in as much as both present ulcerative lesions brought about by the tubercle bacillus. The lupus ulcers of the conjunctiva differ from the tuberculous ones as a rule in that they extend from the skin over into the conjunctiva and like lupus of the skin show spontaneous cicatrisation on one side while the ulcer is still progressing on the other side. (Fuchs) Tuberculosis of the conjunctiva is denominated as secondary when the eye has been secondarily infected from tuberculous sputum. An endogenous infection is to be suspected when the tubercle bacillus has been brought to the conjunctiva through general circulation.

Diagnosis :—The characteristic features of the ulcers coupled with the enlargement of pre-auricular glands and the clinical picture of the case are diagnostic of tuberculous infection, except in rare cases in which nodes or ulcers are seen on the scleral conjunctiva simulating necrotising phlyctenule, when diagnosis becomes a matter for consideration. Diagnosis would be definitely established by the demonstration of tubercle bacillus on microscopic examination. Section examination would show typical giant cell system. In difficult or doubtful cases an inoculation experiment by inoculating a piece of tuberculous tissues into the anterior chamber of a rabbit's eye would bring forth a typical tuberculous iritis. Intraperitoneal inoculation of guinea-pigs may also be experimented upon. Dermal tests or injection of tuberculin are often of help to the clinician.

Treatment :—Indications for treatment are radical excision or curettage of the ulcer followed by thorough cauterisation of the wounded area. This is to be followed by

local as well as general therapy. General therapy consists in attending to the general health of the patient by administration of milk, vitamins, cod-liver oils, etc. I have often used goat's milk with success in such cases. This is supplemented by injection of tuberculin which gives very encouraging and hopeful results. According to Parsons subconjunctival injections of 2% guaicol cacodylate may be employed. In stubborn cases light therapy may be given a trial. In the local treatment iodoform in a fine powder or a 10 to 20% salve to be applied locally on the affected conjunctiva is to be prescribed. Application of 50% solution of lactic acid is also recommended. I have used Susruta's Berberis ointment (3-5grs. Berberine sulph. in one ounce of cream) with success in my cases.

In stubborn cases when the above therapy is of no avail and the diseased process spreads involving the whole eye, excision of the eye may be judiciously called for saftey of the other eye.

Tubercular keratitis occurs most commonly in conjunction with conjunctivitis as tubercular kerato-conjunctivitis.

Tubercular manifestation of sclera may appear in the form of scleritis; it may be a primary manifestation forming a localised nodule which caseates and ulcerates in its usual course. or it may be secondarily infected from the conjunctiva, ciliary body, or choroid.

For treatment excision or scraping is advised, followed by general therapy.

Tuberculosis of the iris is an uncommon ocular affection affecting mainly children and young adults and is not necessarily associated with tuberculosis in other parts of the system.

Tuberculous manifestation of the iris appears generally under two forms: (1) the miliary form characterised by small, grayish nodules appearing near the ciliary or the pupillary border; (2) the conglomerate form, in which there is a single yellowish gray mass in the ciliary part of the iris. In the miliary form nodules appear as minute, grayish and translucent bodies in the early stages. Often spots of "K.P." on the back of the cornea are to be found indicating involvement of the ciliary body. In the conglomerate form' a single yellow gray tumour is manifested. The conglomerate tubercle of the iris is very destructive in nature. In course of its growth it gradually pushes the sclero-cornea at the angle of the anterior chamber and erodes it, thus weakening the wall of the globe until it gives way. The

tuberculous mass then grows fast and peeps through the perforation; the iris becomes prolapsed, and the eye is hopelessly lost.

Treatment.—Symptomatic, specific therapy being duly instituted. Improvement and satisfactory results have been observed by the use of tuberculin injection, beginning with very small doses. In case perforation of the globe has occurred and the eye is spoiled, immediate excision should be ordered.

Tuberculosis of the uveal tract is manifested in the form of uveitis wherein there is choroiditis associated with iridocyclitis. The following clinical features are suggestive of tuberculous uveitis—unilateral appearance, mutton-fat K.P., serous cyclitis, exudative choroiditis, anterior choroiditis, and manifestation of miliary tubercles in the late stages of the diseased process. Besides this marked photophobia in the absence of well marked ciliary injection is noted. (Ratnakar)

It is customary to subdivide uveitis into anterior and posterior: anterior uveitis includes iridocyclitis, which may be complicated with choroiditis, while posterior uveitis involves the choroid alone, posterior part being more involved than the anterior. (Duggan)

Prognosis in connection with the tuberculosis of the uveal tract depends more upon the general health and resistance of the patient than on the form of clinical phenomena. The greater the extent of tuberculous lesion on the uvea, the more unfavourable the prognosis is in regard to the fate of the diseased eye. Extensive involvement of the conglomerate tuberculosis leads to blindness and shrinkage of the diseased eye.

Treatment.—Symptomatic and specific therapy. In addition it is advisable to increase the resistance and general health of the patient by administration of vitamins—cod-liver oil, etc., Calcium, syrup sirolin, syrup of Guiacol, energising foodstuff, residence in a healthy climate etc. Specific treatment by tuberculin beginning with small initial dose; i.e., 0.00001 mg of old tuberculin and repeated weekly once in gradually increasing dosage, gives satisfactory amelioration and even complete resolution.

One should advise enucleation in severe cases of tuberculosis, and invariably in all cases in which the diseased process represents the primary stronghold of the tuberculosis with a view to check the further extension of the infection.

* OCULAR MANIFESTATIONS AND COMPLICATIONS IN INFECTIOUS DISEASES AND THEIR TREATMENT

BY

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Not a year passes without the world witnessing the appearance of infectious diseases, coming singly or in groups or one after another. Practically every year waves of infectious diseases, either in sporadic or epidemic form, inundate the various parts of the earth, causing great consternation and considerable havoc amongst human beings. Some varieties of infectious diseases, such as measles, influenza, etc. are regular annual visitors; certain other types such as small-pox, chicken-pox, diphtheria etc. possess a special predilection to appear in certain seasons of the year and in certain parts of the globe; while the varieties of infectious diseases known as gonorrhœa and syphilis, etc., seem to be pandemic in their nature, being present in the human society, in all seasons of the year and in all parts of the hemisphere. Often, epidemics of infectious diseases, small-pox, for instance, assume such ferocious forms as to become virulent and devastating in their nature, so much so, their control and treatment become a trying problem, both for the practising physician as well as the public health worker.

Every system of the human body, namely, the respiratory and the circulatory systems, the nervous system, the ocular system, etc., bear the brunt of the pathological lesions wrought about by the infectious diseases. Most of these diseases leave behind them permanent legacies of a severe nature, namely, disfigurement of the face with permanent partial or total blindness. The most disastrous result of ocular manifestations of many infectious diseases is, therefore, the incidence of blindness. Considered from a socio-economic standpoint, the disabilities caused by the ocular complications of various infectious diseases are so great as to incapacitate thousands of people to carry on their normal vocations of professional lives. For the human welfare, the knotty problem, dealing with the prophylaxis and successful treatment of infectious diseases, is as vital as the problem of guarding against and combating the onset of ocular complications arising therefrom. The problem of prevention

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of ocular complications in various infectious diseases resulting in partial or total blindness, or in corneal opacities, diminishing visual activity, forms by itself a very important branch of the medical science, both from purely medical as well as social and civic view-points. The subject of Preventive Ophthalmology, as it is now called is not a new subject. It is as old as Vedas; as antiquated as the age of CHARAKA and SUSRUTA. It was SUSRUTA, the world's first surgeon-ophthalmologist, who was the first authority to have issued special instructions for guarding against the dangers of ocular complications. In the post-Susrutian period, HIPPOCRATES dealt with the subject. CELUS (25-30 B.C. to 40-50 A.D.), PAULUS AEGINETA (660 A.D.) and other Greek surgeons—RHAZES (850-932 A.D.) HALY ABBAS after 950 A.D.) AVICENNA (980-1037 A.D.) and other Arabic ophthalmologists, too, have all given proper attention to the subject of Preventive Ophthalmology.

In this short paper, I would briefly deal with the ocular manifestations and complications of various infectious diseases. An attempt would also be made to briefly mention preventive measures as also appropriate therapy for the various ocular complications, due attention being paid to the subject of Preventive Ophthalmology.

For purposes of convenience and scientific accuracy, I would deal with the various infectious diseases which are specified below, according to the classification adopted in Price's Text-book of Medicine, viz.:—

1. *Infectious diseases of doubtful or Unknown Aetiology*: (1) Small-pox; (2) Vaccinia; (3) Measles; (4) Varicella; (5) Scarlatina; (6) Mumps.

II. *Infectious diseases of Spirochætal Infections*:—(1) Syphilis; (2) Yellow Fever.

III. *Infectious Diseases of Bacterial Origin*: (1) Diphtheria; (2) Influenza; (3) Erysipelas; (4) Gonococcus Infection; (5) Whooping cough; (6) Typhoid Fever; (7) Tuberculosis; (8) Leprosy; (9) Cerebro-spinal Fever; (10) Pneumococcus Infection: (11) Septicæmia and Pyæmia; (12) Acute Coryza (common cold).

IV. *Infectious Diseases of Protozoal Origin*: Malaria.

First, I would take up the subject of *small-pox* and consider briefly, the various ocular manifestations and complications arising therefrom.

I. (1) *Small-pox* is an acute, specific, highly contagious disease, characterized by a definite incubation period and by general cutaneous eruptions, which pass through the stages of papules, vesicles, pustules and scabs. All ages and all races are susceptible to this disease, mortality being very high in young children. Three varieties of small-pox are noted:—(1) Variola vera—(i) discrete type; (ii) confluent type. (2) Hæmorrhagic small-pox—(i) purpura variolosa; (ii) hæmorrhagic pustular small-pox. (3) Varioloid—small-pox modified by vaccination.

Small-pox, in India, is as old as the Vedas, for it has been mentioned in the Atharva-Veda (one of the four sacred books of the Hindus) with a characteristic description. CHARAKA, SUSRUTA, and VAGBHATTA—the three great medical authorities of ancient India—have all written on the subject. True scientific study on the subject, however, has been done by Susruta in the pre-historic age. Later on in the 9th century, we find that the celebrated Arabic physician, RHAZES, described the disease very accurately. Again, in the 17th century, SYDENHAM gave a good account of the disease.

Small-pox is one of the common factors, causing either partial or total blindness; when it occurs in an epidemic or endemic form, its ravages caused on the visual apparatus are very disastrous. The best way to prevent incidence of such disastrous ocular complications lies in preventing the disease by means of thorough vaccination aud revaccination. It was in India, long long ago and many centuries before JENNER'S discovery of vaccination, that the hygienic principle of protecting human beings from the ravages of small-pox epidemic by means of inoculation with the pox virus, was first promulgated.

The ocular manifestations, that are usually noticed in small-pox by different observers, are the following:—Conjunctivitis is very common. This leads on, in severe cases, to kerato-conjunctivitis and keratitis suppurativa. Pustules often occur on the palpebral or ocular conjunctiva. Eyelids often become inflamed and œdematous. Severe involvement of the eye may follow on the steps of the ordinary conjunctivitis, especially in neglected cases, and comprise the most fatal complications, leading ultimately to destruction of the organ and loss of eyesight. The various ocular complications, resulting in blindness are: keratitis suppurativa, hypopyon ulcer, rapidly spreading corneal ulcer, leading on to perforation and prolapse of iris, iritis, iridocyclitis and panophthalmitis. Incidence of secondary glau-

coma is not uncommon and most often retinal hæmorrhages occur.

In cachectic children, intense conjunctivitis may appear and to lead on to extensive corneal ulceration and even perforation of the cornea, severe intra-ocular inflammation with ultimate destruction of the eye.

Most of the cases of blindness from small-pox are due to infected corneal ulcers. Hence, the most scrupulous attention should be given to the eye to check the spread of corneal ulcer. Every precaution should be taken to prevent serious intra-ocular complications. Irrigation of the eye—morning and evening—with warm antiseptic and antiphlogistic lotions, such as Boric Lotion, Lotio Hydrarg, Oxycyanide (1 in 15,000) and decoctions of Triphala (*Terminalia Chebula*, *Terminalia Belirica and Embelica Officinalis*) and Daru-haridra (*Beriberis Asiatica*). Susruta advised that it should be a routine measure to irrigate the eye regularly with an antiseptic eye lotion in a case of small-pox.

To rid the conjunctival sac from infective organisms, it should be duly washed with an antiseptic lotion such as Lotio Hydrarg Oxycyanide (1 in 15,000) and 4% to 5% Argyrol drops should regularly be put into the eye. In the event of there being discharge from the conjunctival sac, eye-drops of 10% Argyrol lotion should be given; should the cornea be found to ulcerate, Lotio Atropine (4 grs. to 1 oz. distilled water) should be dropped twice daily and Yellow Oxide of Mercury Ointment applied to the eyelids. Infected lacrimal sacs and septic rhinitis often aggravate the spread of corneal ulcers, hence they should be regularly examined and rigidly attended to.

If the attending surgeon should check the spread of corneal ulcers and hypopyon ulcers by attending to the above details, namely, antiseptic irrigation of the conjunctival sac, prompt treatment of conjunctivitis and keratitis and guarding the sources of infection; *e.g.*, from lacrimal sac etc., then most of the eyes would be rescued from blindness.

(2) In the case of *Vaccinia*, accidental vaccinal inoculation of the eyelids is not uncommon. Involvement of the cornea usually occurs secondarily subsequent to the vaccinal infection of the eyelids and conjunctiva.

The corneal lesions, resulting from vaccinal infection are the following:—Slight superficial infiltrations on the

cornea, superficial vesicles, disciform keratitis, ulcers and pustules which may lead on to perforation and its concomitant complications.

The fate of the superficial types of corneal lesions is that they generally heal uneventfully, with little or no residual opacity, while that of the deeper forms is that they leave scars of varying density, causing considerable impairment of vision in the affected eye.

SCHIRMER was the first ophthalmologist to report a case of post-vaccinal disciform keratitis in 1891. FUCHS in 1901 drew the attention of the ophthalmic surgeons to the clinical entity which he called as disciform keratitis. Again in 1904, SCHIMER reviewed the subject of postvaccinal disciform keratitis in a learned article. In recent years, MORAX SMITH GRITTER, SINAIKO, PORTOGHESE, and others have observed the incidence of post-vaccinal disciform keratitis.

The treatment of this condition consists in the use of antiseptic lotions and hot Boric compresses and regular atropinisation. The post-vaccinal lesions on the eyelids, resulting in conjunctivitis could also be attended to by antiseptic and antiphlogistic eye-washes and soothing ointments.

(3) *The ocular manifestations and complications of measles* would next be discussed. Catarrhal conjunctivitis with severe conjunctival injection is the first ocular manifestation of measles. Muco-purulent conjunctivitis and corneal ulcers are the important and severe ocular complication of measles, as these conditions leads to severe intra-ocular inflammation, resulting in loss of sight.

Measles is a common cause of blindness through corneal ulceration. Hence, it is very imperative upon the physician to give proper attention to the speedy treatment of the eyes.

Blepharitis and phlyctenular kerato-conjunctivitis are common sequelæ. The physician should give utmost care to protect the eyes of cachectic and debilitated children, suffering from measles, as in such cases an intense form of conjunctivitis appears leading to extensive corneal ulceration perforation of the cornea, intra-oculor inflammation with destruction of the eye.

Local treatment consists in frequent irrigation of the eye with an anti-septic eye-lotion and the application of a

little dilute Nitrate of Mercury Ointment to the eyelids. In more severe cases, eye drops of Silver Nitrate solution (2 grains to the ounce) should be given. A 2 per cent solution of Protargol is also advised. Atropinisation and application of Unguentum Flav. Dil. are prescribed in cases of corneal involvement.

(4) *Varicella*:—The ocular manifestations are conjunctivitis, followed by keratitis, as the eruptions may involve the conjunctiva and afterwards the cornea. The manifestations are, however, mostly mild in nature.

(5) *Scarlatina*:—The ocular complication is generally a catarrhal form of conjunctivitis, milder in nature than that of measles. Corneal involvement is rare. These manifestations are noticed mostly in the convalescent stage. When scarlet fever is complicated with nephritis, the characteristic ophthalmoscopic picture of albuminuric retinitis may be found.

(6) *Mumps*:—Oedema of the lids may occur, followed sometimes by catarrhal conjunctivitis. The other complication is dacryo-adenitis, occurring in a small number of cases.

II. (1) Next, I would consider *the ocular manifestation and complications of syphilis.*

Although, syphilis is primarily, a disease of the genitals, yet it affects all the other systems of the human body, and as such, the eyes are liable to be infected in its train, both in the primary and secondary stages. Primary involvement of the eyes, however, is rare, while secondary ocular involvement is very common.

All the different structures of the eye are susceptible to this infection, although the cornea, iris and the retina seem to possess a special affinity for such infections. The ocular manifestations of syphilis may appear, at any time, so long as the specific organism—the Spirochæta Pallida—is active and alive.

Syphilisation of the ocular system, both in the congenital and in the acquired forms, accounts for a considerably large percentage of blindness. In India, as elsewhere, congenital syphilis contributes a good percentage to the incidence of blindness. HERMANN found definite evidence of congenital syphilis in one-third of a group of 1,855 blind children, and in nearly all the cases of blindness, congenital syphilis was found to be responsible. At

least 10 to 15% of cases of blindness in adults are probably due to syphilis. (PARSONS)

The usual ocular manifestations of syphilis are syphilides of the eyelids, gummatous infiltrations of the orbit, plastic iris, interstitial keratitis, gummatous episcleritis, neuro retinitis and chorioretinitis etc. All these usually respond to the appropriate therapy, when early and timely instituted.

Syphilitic manifestations of the eyelids and tarsus:—Syphilitic involvement of the palpebral conjunctiva may be present as primary, secondary or tertiary lesions or as hereditary manifestations. A primary syphilitic lesion is occasionally found either in the inter-marginal space or at the canthus or on the tarsal conjunctiva.

Gummata is the most common of the syphilitic manifestations of the eyelids. This usually causes pathological fibrosis, resulting in thickening of the tarsus, the condition being known as syphilitic tarsitis. The syphilitic ulcer of the lid is a small circumscribed ulcer, covered with scanty grayish discharge and indurated at the base.

Treatment of this condition consists in giving antiseptic eye-washes of Mercury Perchloride lotion 1 in 10,000, and application of Yellow Oxide Ointment at bed time. When the cornea is affected, Atropinisation 1% and Lotio Dionine 2% would be employed. Side by side with this local treatment an intensive course of anti-syphilitic treatment, Salvarson, Iodide, etc, should be duly administered.

Syphilitic manifestations of cornea:—Interstitial keratitis is the most common affection which is otherwise known as parenchymatous keratitis. It is a chronic cellular inflammation of the middle and posterior layers of the cornea, of frequent incidence in childhood, not leading to ulceration but accompanied by inflammation of the uveal tract.

Local treatment consists of atropinisation, hot compresses application of mild stimulating ointments such as Yellow Oxide of Mercury and Calomel. General treatment consists of administering Calomel $\frac{1}{10}$th grain 4 times daily, Gray powder 1 grain twice a day or Pottasium Iodide 5 grains combined with corrosive sublimate $\frac{1}{40}$th grain t. i. d. Besides this, syrup of Ferri Iodide, Cod-liver-oil, Iron and Quinine would very much help the favourable course of this disease.

Recently, MOORE advocated continuous therapy, consisting of alternating courses of Arsphenamine and Bismuth compounds. SCHAMBERG and WRIGHT reported good results

by giving a course of alternate injections of a Bismuth compound and Sulpharsphenamine.

MENAGH has reported four cases of interstitial keratitis in three of which the syphilitic condition cleared up after the addition of hyperpyrexia to chemo-therapy. The therapeutic efficacy of fever therapy favourably influences the courses of the diseases and tends to alleviate and soothe the distressing symptoms of pain, photophobia, blepharospasm and lacrymation. Lowenstein advocates the use of Rœntgen rays as being very efficacious, especially in patients with resistant corneal opacities.

Atrophy of the optic nerve:—This effection is manifested either as a primary disease or secondary to some other affection of the nerve or retina. The primary type of atrophy of the optic nerve has been noticed in cerebro-spinal syphilis, tabes and dementia paralytica. Such affections are fortunately of rare occurrence. When such a condition is untreated, the inevitable consequence is blindness. The prognosis is good in cases when the atrophic process is still unilateral and visual acuity and fields in the better eye are almost normal. The prognosis is, however, grave in those cases where there is simultaneous bilateral loss of visual acuity and contraction of form and colour fields.

The prognosis of atrophy of the optic nerve is generally unfavourable. " The recent trends in the therapy of ocular syphilis offer a much more hopeful prognosis than is generally believed. The institution of the newer remedies together with those proved efficacious over a period of years will greatly lessen the incidence and prolongation of of ocular complications". (LEVIN and BEHRAM)

The treatment, in general, consists in attempting to counteract the cause of atrophy. When it has to do with a definite syphilitic lesion of the optic nerve or its neighbourhood, the institution of antiluetic therapy is indicated. Treatment with Pottasium Iodide, Strychnine injections, Galvanisation may be undertaken as useful collateral medicaments.

The modern treatment of this condition consists of employing what is known as the Swift-Ellis method of intra-spinal Arsphenamine therapy as well as the hyperpyrexia therapy. A course of seven to ten injections of intraspinal Arsphenamine therapy is given at intervals of two weeks, this being followed by a course of injections

of Bismuth compound. The intra-cisternal route may be advantageously employed in administering the medicament. There may be therapeutic shock as a result of combined subdural and intravenous therapy, but the risk is far outweighed by the possibility of arresting inevitable blindness. Treatment should be employed for ever a period of six months.

The employment of hyperpyrexia therapy is primarily intended for those cases of optic nerve atrophy, associated with paresis or dementia paralytica of the tabetic form. The role of hyperpyrexia therapy in the treatment of ocular syphilis has been investigated by various notable workers namely, CLARK, MENAGH, CULLER, SIMPSON and others. CLARK made a study of twelve cases, in which he established the role of malaria therapy in the control of atropy of the optic nerve due to syphilis. His findings were very encouraging, as benefit was obtained in 8 out of 12 cases. Besides malaria therapy, intramuscular injections of Sulpher have also been used to induce high temperatures. MENAGH used fever therapy in 10 cases of optic nerve atrophy. His findings on his observation of the therapeutic efficacy of hyperpyrexia are very instructive. He concluded that, when there was damage due to localised cellular infiltration, as is the case in tabes, the disease would readily yield to fever therapy and to early treatment. But, in the case of dementia paralytica, in which the pathologic process spreads from the brain to the optic nerve, the disease is very much resistant to fever therapy. According to the observations of CULLER and SIMPSON, ocular syphilis due to exudative lesions should be expected to respond favourably to hyperpyrexia therapy.

Syphilitic lesions of the uveal tract.—Syphilitic involvement of the uveal tract and its component structures, the iris, etc., generally occurs in late secondary syphilis. The general therapy employed in such cases is a course of Arsphenamine, alternating with a course of Bismuth compound along with the administration of Iodides by mouth. The local treatment of iritis consists of atropinisation. Administration of Salicylates for the alleviation of pain, and complete rest in bed, are also advocated as adjuvants to the main therapy.

The other ocular manifestations of syphilis are chorioretinitis and dacrocystitis. Chorio-retinitis is more often a complication of acquired syphilis. This lesion may also appear in congenital syphilis prior to the appearance of interstitial

keratitis. The use of fever therapy, foreign protein therapy in conjunction with chemo-therapy, is advocated in the treatment of this condition. Syphilitic involvement of the lacrymal sac generally occurs in persons with congenital syphilis. The treatment of this condition is mainly surgical.

(2) *Ocular manifestations in yellow fever.*—In the early stage, conjunctival irritation and congestion are noticed, this congestion being modified by the appearance of yellowish-discoloration at a later stage. Sub-conjunctival hæmorrhages are common and retinal hæmorrhages are often found.

TREATMENT is symptomatic.

III. (1) *Ocular manifestations and complications of diphtheria* are considered next. Conjunctival diphtheria is generally the result of direct inoculation but the conjunctiva may be infected from the nose in cases of nasal diphtheria. In ordinary forms, it may stimulate a benign, simple form of conjunctivitis or a membrane may form on the inner aspect of the eyelids. In severe manifestations of diphtheria, there is extreme inflammatory infiltration of the conjunctiva which may secondarily lead to keratitis suppurativa, sloughing of the cornea due to extensive ulceration and ultimate destruction of the eye. Diphtherial infections also cause cycloplegia, and rarely paralysis of the external rectus muscle—all these are post-diphtherial symptoms. Occasionally, optic neuritis occurs.

Treatment consists of giving intramuscular injections of specific diphtheria antitoxin of 4,000 to 8,000 units. Local treatment consists of fomentations, irrigation of the conjunctival sac with an antiseptic and antiphlogistic lotion. In case of corneal involvement, Guttæ Argyrol 20% b.d. and Guttæ Atropine are advocated for regular use.

(2) *Influenza.*—The ocular manifestations of influenza are usually conjunctivitis catarrhalis and the herpetic types of keratitis. The complications are iritis which is common and optic neuritis which is of rare incidence.

TREATMENT consists in antiseptic irrigation, hot compresses and atropinisation.

(3) *Erysipelas*:—In this case, the ocular manifestations are generally abscesses and gangrene of the lids, orbital cellulitis in serious cases. The complications are thrombosis of the orbital veins and cavernous sinus.

TREATMENT consists in the employment of immune therapy as well as the local use of antiseptic and antiphlogistic medicaments.

(4) *Gonococcus infection*:—The ocular manifestations of gonorrhœl infections are the two well-known eye diseases, namely, gonorrhœal ophthalmia or adult purulent conjunctivitis and ophthalmia neonatorum or infantile purulent conjunctivitis.

(5) *Whooping cough*:—Conjunctival hæmorrhages are very common in whooping cough. Retinal hæmorrhages do sometimes occur. Detachment of retina may occur in very obstinate cases of whooping cough.

TREATMENT is mainly symptomatic, due attention being paid to the treatment of whooping cough.

Ocular manifestations of leprosy:—Involvement of the eyelid is common. The cornea is the most vulnerable ocular tissue. Leprous involvement of the sclera is found at the corneo-scleral junction. Iritis is common, choroid and ciliary body being involved in its train. Opacity of the lens has been observed in many cases. Lesions in the retina, optic nerve and lens are, however, rare.

TREATMENT is both symptomatic and specific therapy.

(9) *Cerebro-spinal fever*:—Complications involving the eye, are very variable and yet, in relation to the essentially nervous character of the main lesions of the disease, they are not very common. Fortunately, with the single exception of that form of blindness so often seen in the recovered cases of the post-basic type of the disease, very few of the eye complications are permanent. Inflammatory lesions include conjunctivitis, keratitis, iridocyclitis and rarely cellulitis of the orbit. Nervous lesions include extrinsic ocular defects which are not uncommon, but are generally transitory. Amaurosis is relatively common in the post-basic infection of infants; it is fortunately unusual in the more acute infection of children and adults. It is in most cases unaccompanied by any changes in the optic disc and is, therefore, to be attributed to cortical changes, associated with hydrocephalus. In some cases, however, a state of secondary optic atrophy is present. Optic neuritis is not a common complication; but papillitis or a lesser degree of change even than this, is said by French authors to be extremely common. (THOMAS HORDER)

(10) *Pneumococcus infections*:—The ocular manifestations are herpes of the cornea, followed later on by corneal ulceration.

(11) *Septicaemia and pyœmia*:—The ocular complications are retinal hæmorrhages which are common. Embolism in the choroid and retina occurs sometimes, this in turn results in purulent choroiditis and panophthalmitis leading on to destruction of the eyeball.

Ocular manifestations of acute coryza (common cold) Catarrhal inflammation of the palpebral conjunctiva and the tear ducts, resulting in the running of the eyes.

TREATMENT is symptomatic.

IV. In *Malaria*, the following ocular manifestations and complications are observed:—Jaundice of the conjunctiva, herpes corneæ febrilis which are common in severe cases. Optic neuritis, retrobulbar neuritis, hæmorrhages into the retina and vitreous, amblyopia, paresis of accommodation are unusual complications.

CONCLUSION

The ocular complications, resulting from various specific infective diseases, e.g., small-pox, measles, gonorrhœa, syphilis, etc., contribute to not a small percentage of the incidence of blindness in India, as well as in different parts of the world. It is the general medical practitioner who is the first authority to detect the occurrence of ocular manifestations and complications. No act of humanity is more glorious and more sacred than the humanitarian mission of preventing the incidence of blindness or of relieving blindness, when is amenable to treatment. In this noblest of noble nation-building work, no one is perhaps more fitted to achieve success than the medical practitioner, working in consultation with an ophthalmic expert. The healthy co-operation of eye-expert with the general medical practitioner would be required to successfully combat and control the incidence of ocular complications (resulting from various infectious diseases etc.) which threaten the destruction of the visual apparatus of millions of the world's inhabitants.

In the compilation of this paper, I have consulted the works of various authorities to all of whom, I gratefully tender my indebtedness.

Vitamin B, C, D in Ophthalmology

BY

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Sonpur Raj

The role of vitamin B in the etiology and treatment of ocular diseases. It is to be noted that vitamin B Complex is a group of water-soluble substances, the presence of which is very essential for the healthy condition and growth in man as well as in other animals. Of the many components of vitamin B the following have been chemically identified:—

Thiamine (or vitamin B_1):—This is the anti-neurotic and anti-beriberi vitamin. It is now known that thiamine acts as a catalytic agent in the combustion of carbohydrate, which in its absence is arrested at the pyruvic acid stage, the metabolite having a toxic effect on nerve tissue (Veasey). In human beings thiamine deficiency is responsible for the causation of a non-inflammatory peripheral neuritis and paralysis but not nerve degeneration. Insufficient absorption of vitamin B_1 may occur in cases of dysfunction of the bowel even when the dietary intake is adequate.

In the case of the average adult the minimum amount prescribed for the prevention of beriberi is about 300 international units, or 1 mg. of thiamine hydrochloride per day.

Riboflavin (vitamin G or B_2.):—This vitamin component combines in the body with a protein forming a fervent which is concerned in cell respiration. Absence or deficiency of this vitamin factor brings about degeneration of central and peripheral nerve tissue, Keratitis and cataract formation in laboratory animals. Although its exact role in human nutrition is unknown its absence along with thiamine deficiency is partly responsible for the causation of degenerative changes of beriberi. Ariboflavinosis is said to cause a syndrome called cheilosis, and certain forms of Keratitis and swelling of the lens. The usual daily requirement for a human being is 2 to 3 mg.

Nicotinic acid has been proved to be the pellagra-preventing (P. P.) factor in human beings and anti-black-tongue factor for dogs. Certain pschyotic states are mani-

fested in human beings owing to nicotinic acid deficiency. Photo-sensitivity leading to dermatitis from sunlight is caused by the deficiency of this factor. Human requirements are unknown, but the maintenance dose is over 200 mg. per week (Veasey).

Vitamin B_6 :—This component of vitamin B complex has been isolated and identified as pyridoxine and has also been synthesised. Its exact role in human nutrition remains still unravelled. Avitaminosis B_6 in the rat brings about a specific form of dermatitis with loss of hair about the eyes, while in the case of dogs and pigs it causes microcytic hypochromic anæmia.

As for the remaining components of the vitamin B complex they still remain unisolated, being clinically recognised only by the effect of their absence in the foodstuffs of laboratory animals. These remaining components are mentioned below :—

Vitamin B_2 —This is necessary for stimulating growth and appetite in pigeons.

Vitamin B_4 —This is preventive for a specific paralysis in rats and is necessary for chicks.

Vitamin B_5 —Concerned in the growth of pigeons—preventing loss of weight in them.

It would be instructive to deal briefly on the data in connections with ocular physiology and the distribution of thiamine and reboflavin in the eye. In this connection the works of Fischer, Offret, Buschke, Yudkin, Van Heuven, Hogan, Rachevskiy, Adler and Von Euler and others are commendable.

In his studies on the presence and significance of vitamin B in the crystalline lens, Fischer (1938) showed that (1) the normal lens contains vitamin B, to the extent of 0.001 microgram (2) that it contains no thiochrome which is a photo sensitive oxidation product of thiamine (3) that a cataractous lens contains no vitamin B_1. Fischer further demonstrated that the deficiency of vitamin B_1 in cataractous lens disturbs the glucoside mechanism thereby allowing accumulation of pyruvic acid, which characterises progressive specification of the lens; and the relation obtaining between pyruvic acid and thiamine is such that when there is a deficiency of Vitamin B_1 (thiamine), pyruvic acid has a tendency to accumulate. Moreover

it was experimentally shown that the denser the cataract the greater the quantity of pyruvic acid. In view of these investigations Fischer concluded that (1) defective metabolism of the glucosides plays an important part in the pathogenesis of cataract, (2) it is characterised by an incomplete reduction of pyruvic acid into lactic acid and (3) finally it is due to the disappearance of vitamin B_1 in the cataractous lens.

According to Offret (1938) (who investigated the subject of avitaminosis and their relation to the visual apparatus), thiamine acts on the neuro-sensory apparatus as well as on the motor apparatus of the eye. Regarding riboflavin (vitamin B_2) it is present in normal lens and wholly absent in cataractous lens. The quantity of riboflavin diminishes with the advancement of years (Fischer, cited by Buschke, 1936). Riboflavin is considered as one of the essential factors for the maintenance of the normal condition of the lens (Yudkin, 1938). According to Van Heuver (1938), its presence in the lens is necessary for the conduction of light. The amount of riboflavin present in the human eye is 0.2 to 0.4 microgram (Hogan, 1938). The studies of Rachevaki (1937) show that the yellow colour of the human lens is partly due to the presence of riboflavin. It is known from the findings of Kodickova-Hradecka and his collaborators (1937) that the lenticular ascorbic acid is reduced in rats which are kept on a diet deficient in vitamin B complex. From Van Heuven (1938) we know that large quantities of riboflavin are present in the retina. The investigations of Adler and Van Euler (1938) demonstrated that riboflavin is found in the retinal pigment of fish in a concentration which is 25 times that present in the liver. Free riboflavin is found in the eye, in milk as well as in urine. According to these observers riboflavin is essential to the eye, because of its inherent properties of fluorescence and photo-sensitivity, while according to Offret it is concerned with lenticular respiration. Thus we see that the data concerning ocular physiology and the distribution of thiamine and riboflavin are too few, and mostly uncorrelated.

Sources of vitamin B:—Vitamin B is soluble in water, hence called water soluble vitamin B. It is present especially in seeds and eggs of animals. In cereals it is present mainly in the embryo, while in pulses it is distributed throughout the seed. Other sources of vitamin B are yeast, vegetables, potatoes (sufficient quantity), meat of liver, kidney (moderate amount), and milk. Vitamin B is the antineurotic and anti-beriberi vitamin; this is soluble in water, glycerine and alcohol. It is a thiozol-

pyrimidine compound, the formula being C_{12} H_{16} N_4 OS (Windaus 1932, and Williams, 1934). Williams in 1936 synthesised and determined its chemical structure. Its most potent natural sources are yeast, wheat-germ and rice-polishings. The vitamin B complex includes the anti-pellagric factor (Goldberger), vitamin B_6, and vitamin B_2 or G (Riboflavin). This is soluble in water and dilute alcohol. Its most potent sources are yeast, milk and liver.

We shall next consider the various ocular manifestations resulting from avitaminosis B. For the sake of convenience of description we shall consider serially the various ocular structures with their possible involvement due to vitamin B deficiency.

Eyelids, Conjunctiva and Cornea:—The ocular symptoms of Beriberi are Oedema of the lid, Corneal changes and Conjunctival changes (Buschke). Phlyctenular Kerato-Conjunctivitis may be caused by vitamin B deficiency, this condition being corrected by a diet high in refined starches (Maintland). Milhaud reports the incidence of styes due to vitamin B deficiency, this being cleared up by the administration of yeast. Keratomalacia has been reported in cases of pellagra possibly in association with avitaminosis A. Cases of superficial Keratitis in association with ariboflavinosis have been reported by Takeda. Certain types of corneal ulcerations, not yielding to the usual therapeutic measures, but promptly ameliorated by the vitamins A and B therapy have been observed by Yudkin According to Koepcke (1937) both vitamins A and B are prescribed for the treatment of corneal ulcers. Two cases of herpetic Keratitis have been successfully treated by thiamine therapy (Nitzulescu and Triandaf, 1937). In these cases injections of 6 mg. of thiamine hydrochloride daily for 5 days were required to effect a cure. Kruse and his collaborators reported there, incidence of 9 cases cheilosis and keratitis due to avitaminosis B which cleared up on riboflavin therapy, reappearing when the diet became deficient in this specific vitamin. Two cases of interstitial keratitis in congenitally syphilitic patients have been observed by Kruse and his co-workers as responding remarkably to riboflavin therapy. In such cases there was a poor response to anti-syphilitic therapy alone.

Ocular manifestations of pellagra.—The earlier observers (Soler, 1871; Rampoldi, 1885) described the incidence of such eye symptoms as inflammation of the cornea, corneal ulcers and opacities; while Clark (1909) observed pain in the eyes, conjunctivitis, failing vision and iritis, and Whaley

noted photophobia, mydriasis, and superficial inflammation of the cornea among other eye lesions in pellagra. A lesion of the eyes characterised by bulbar conjunctivitis, lacrimation, burning sensation in the eyes and failing vision—these ocular lesions occurring in pellagrins have been noted by Spies, Vilter and Ashe (1939).

Photophobia, Epiphora with dryness and anaemia of the conjunctiva and corneal opacity—these ocular symptoms have been observed in pigeons suffering from thiamine deficiency, Katajama, cited by Buschke, (1936). Some observers (Day, Darby and Langston, 1937) have noted the occurrence of alopecia and falling eyelashes in riboflavin deficient rats; while others (O'Brien and others) have noted the incidence of sanguino-purulent conjunctivitis in such conditions.

Keratitis has been observed as a very prominent symptom in course of experimental production of cataracts in rats which were maintained on riboflavin deficient diets (Day, Langston and O'Brien, ; and Langston, Day and Cosgrave, 1933); while corneal vascularisation with turbidity due to leucocytic infiltration has been observed in course of similar experiments conducted by Bessey and Wolbach (1939) who employed riboflavin therapy successfully in such cases.

Lens :—Following the classical investigation of Day, Langston and O'Brien (1931) in connection with the experimental production of cataracts in albino rats maintained on a riboflavin-deficient diets, the attention of the research workers has been diverted to the study of the important problem relating to ariboflavinosis and the incidence of cataract in laboratory animals as well as human beings. The literature relating to this part of the subject provides ample evidence in support of the fact that the administration of riboflavin arrests the formation of cataract in riboflavin-deficient animals but there is practically of no evidence to justify that a similar effect occurs in the human being with the possible exception of the arrest of the swelling of the lens in cases of intumescent senile cataract.

In 1931 Day, Langston and O'Brien observed the incidence of cataract in 45 of 48 albino rats kept on riboflavin deficient diets. The lenticular opacities, failed to progress after the administration of riboflavin thereapy. Day, Darby and Cosgrave (1938) investigated the problem relating to the arrest of nutritional cataract in riboflavin deficient rats. These observers reported the appearance of cataracts in 52 days in 13 of 16 riboflavin deficient rats, the cataracts having proceeded to maturity in 75% the animals in 67 days. By feeding 25 rats

having incipient cataracts with 120 micrograms of riboflavin twice a week the following results were obtained:

Cataracts arrested in both eyes in 11 rats. Cataracts arrested in one eye in 6 rats, while in the other eye the cataracts proceeded to maturity.

Cataracts proceeded to maturity in 2 rats.

The lenses were clear after the clearance of Keratitis in 6 rats.

These observations in laboratory animals clearly indicated that riboflavin was the substance whose deficiency caused the appearance of cataract and that arrest of cataract formation would occur with the restoration of that substance in the diet.

Day and Darby (1936) conducted experiments to demonstrate the inverse relation existing between growth and the incidence of cataracts in rats given graded amounts of vitamin-C containing foods. The observations of Mitchell and Cook (1938) showed that neither vitamin B_1 or B_2 is concerned in the causation of lactose and galactose cataracts as studied by Yudkin and Arnold (1935). Tainter and Borley (1938), who studied the influence of vitamins and dinitrophenol on the production of experimental cataract, were unable to produce cataracts in riboflavin deficient rats. The experiments of Ahmad and Guha (1937) failed to produce cataracts in rats by riboflavin deficiency.

While riboflavin deficiency in rats causes cataract formation, there are practically no reports supplying the fact that persons with cataract are deficient in riboflavin, and there is factually nothing to support that riboflavin deficiency in human beings has an effect similar to that observed in the case of the rat.

Derkac (1938) in his studies on the medical treatment of senile cataract (in which sub-conjunctival injections of vitamin C, and intramuscular injections of riboflavin were employed gave the opinion that the incipient cataract can be helped but not cured by the vitamin therapy. According to Yudkin (1939) the intumescence of the lens, in many cases, can be reduced by giving 2 teaspoons of potent yeast powder and the juice of two lemons daily before meals. In such cases no improvement was noticed after striae was present. Veasey (1941) reported a case with incipient senile cataract in a patient in whom the progressive swelling of the lens was apparently arrested by parental administration

of riboflavin and oral administration of vitamin B complex. The peripheral opacities, however, remained unaltered. For the treatment of incipient cataract Laval advocates the use of concentrated yeast tablets (vitamins B_1 & B_2 owing to the sulpher content because there exists some connection between the sulpher content of fish lenses and the prevention of human cataracts as observed by Shropshire as well as between cystine and galactose cataracts in rats as reported by Bellows and Rosner. In 1938 Wagner, Richner and Karbacher, investigating the subject of cataract therapy by administration of vitamin B_2 controlled by Slit lamp microscopy, treated 11 patients with riboflavin for 6 to 7 months. One group was given 2 riboflavin tablets daily, while the second group received intravenous injections of 1 c. c. of 0·5% solution of riboflavin. As a result of these, observations, their conclusion was that riboflavin is not efficient in the treatment of cataract.

Optic nerve :—There is a good deal of literature to show that retrobulbar neuritis occurs from avitaminosis B. In 1929 Shastid observed the incidence of 2 cases of optic neuritis of unknown cause which were successfully treated by large doses of the vitamin B complex in the form of wheat germ extract in one case and yeast in the other. The occurrence of retrobulbar neuritis due to beriberi has been reported by Soriano and Puiggari (1938). The incidence of retrobulbar neuritis in pellagra has been observed by Fine and Lachman (1937). According to Kyrlov (cited by Buschke) impaired vision with temporal pallor and construction of finer vessels was observed in many of the patients suffering from pellagra. Laval (1939) reported the occurrence of optic neuritis in pellagra, the condition being cured by yeast; while Moore (1930-1937) described the occurrence of a syndrome of pellagrinuous nature, among Nigerians, characterised by reduced vision, photophobia, sore tongue while patches at the edges of the lips, and a dry, scaly and itchy scrotum followed later by the appearance of temporal pallor of the disc, leading on to primary atrophy of the optic nerve. Cure was effected by giving marmite (vegex) and autoclaved yeast.

Toxic Amblyopia :—There is ample evidence showing that this ocular condition is manifested by the action of the poisons on optic nerves when the threshold has been lowered by deficiency of vitamin B (Grosz). Yudkin in his studies on ocular conditions produced in experimental animals by dietary changes (1933) reported the cure of alcohol and tobacco amblyopia by giving a diet rich in

vitamins without stopping the use of these noxious drugs. Other observers who treated similar conditions successfully with vitamin therapy are: Caroll (1937) who employed yeast in the diet; Caroll and Goodhart (1938), who used parenterally thiamine hydrochloride in doses of 10 or 50 mgs; and Johnson (1939) who used 12 mg. of thiamine hydrochloride daily. According to Laval (1939) the use of concentrated yeast tablets (to supply large amounts of vitamins B_1 and B_2) is advocated in all cases of retrobulbar neuritis, toxic amblyopia and optic atrophy occurring as a result of nasal sinus infection, alcohol or tobacco poisoning or multiple sclerosis. Schachter-Nancy (1938) advocates riboflavin therapy in multiple sclerosis.

Wagener and Weir (1937) have described a syndrome associated with post operative and gestational nutritional deficiency, characterised by optic neuritis, retinal hæmorrhages, paralysis of ocular muscles and nystagmus, these symptoms being suggestive of hæmorrhagic superior poliencephalitis (Wernickes disease) which according to the findings of Ecker and Woltman (1939) is caused by avitaminosis B—possibly due to deficiency of thiamine and nicotinic acid. Vitamin B therapy is attended with marked success in such conditions.

Besides the aforementioned diseases, the following ocular conditions have been observed in association with avitaminosis B:—Uveitis (Lane, cited by Buschke); chorio-retinal disturbances (Yudkin); asthenopia (Lane): and retinal hæmorrhages with the presence of numerous white spots (Cronin), Vitamin B therapy is indicated in the treatment of all these ocular conditions.

VITAMIN C IN OPHTHALMOLOGY

Next we would discuss briefly the role of vitamin C in eye diseases. Vitamin C the antiscorbutic factor, is mostly found in citrus fruits namely, lemons, oranges and grape fruits and lime, as well as in raw vegetables such as cabbages, lettuce and tomatoes. Vitamin C is soluble in water, diluted alcohol and insoluble in oils, and fats. The crystalline vitamin C, first called ascorbic acid, and designated later as cevitamic acid, seemed to be identical with hexuronic acid which was discovered by Szent-Gyorgyi in 1928. The isolation of crystalline vitamin C was announced by King and Waugh of the Pittsburg University in 1932. Soon after King's announcement of the discovery of crystalline vitamin C, Szent-Gyorgyi and Svirbely in Hungary (1932) confirmed the identity of hexuronic acid

with vitamin C. The formula of cevitamic acid is determined as C_6, H_8, O_6 (Cox and Hirst).

From the works of Muller, Muller and Buschke, Biette, Bellows and Rosner we learn that in normal eyes the lens and the aqueous are rich in vitamin C, while in the cases of the cataractous lens the quantity of vitamin C is diminished or totally absent. The aqueous of the aphakic eye contains only a slight amount of vitamin C. According to Biette the decrease or the absence of vitamin C in the aqueous as well as in the cataractous lens is merely a result of the cataractous process.

That the use of vitamin C therapy would influence the course of senile cataract must at present be considered an interesting problem awaiting thorough investigation and solution. Bellows (cited by Gifford) gave large amounts of vitamin C to patients with incipient cataract but did not observe any change in vision or in the appearance of the lenticular opacities.

Urbanek (1938) who investigated the problem of vitamin C metabolism of patients with cataract arrived at the following conclusions, namely:—

1. The juvenile organism is better provided with vitamin C than the senile organism.

2. The formation of cataract in older persons is not always dependent on avitaminosis, because it was found that well nourished patients with cataracts presented vitamin C contents similar to those of juvenile persons.

3. The decrease of vitamin C in senile persons, does not lead to the conclusion that the development of cataract is the result of vitamin C deficiency.

4. The uniformity of ascorbic acid in the aqueous humour which is independent of the saturation of the organism, indicates, that the deficiency of vitamin C contents in the aqueous humour takes place much slower than that in the blood stream; while it is probable that an increase in the content of vitamin C will occur slower in the aqueous humour than in the blood serum.

5. "The lens is neither necessary nor responsible for the formation of vitamin C in the aqueous humour." (Cited by Stoll)

According to the observations of Seefried (1938) patients with senile cataract require for saturation a greater intake

of vitamin C than controls of the same age whereas the findings of Karbacher (1939) show that there is no marked difference in saturability with vitamin C between patients affected with cataract and normal controls of the same age. From the investigations of Bellows (cited by Laval) we know that lactose and galactose cataract produced in the albino rat is due to a loss of the sulph-hydryl content of the crystalline lens which can be delayed by cystine and to a lesser extent by vitamin C in this class of cataract. On the basis of this observation it would seem advisable to try vitamin B_1 and B_2 as well as vitamin C therapy in cases of incipient cataract.

From the above observations it would be seen that the views of different investigators in regard to the role of vitamin C in the etiology and prevention of cataract formation are at variance with one another. Further researches are indicated to show whether it would be practicable to prevent cataract formation in senile persons by saturation with vitamin C. For the present it would seem reasonable, however, that in cases of incipient cataract progress of the lenticular opacities might be delayed or prevented. also by ensuring a proper dosage of vitamin C in the diet.

The observations of Urbanek have shown that post-operative hæmorrhages in the anterior chamber of patients affected with cataracts are caused mostly by a lack of vitamin C or by relative avitaminosis C and that other intra-ocular hæmorrhages can be prevented in most instances by saturation with vitamin C. Hence the use of vitamin C in sufficient doses is indicated for the control of intra-ocular hæmorrhages whether due to trauma (operative or otherwise) or to some metabolic diseases such as diabetes. According to Laval and Yudkin the use of juice of citrus fruits in very large doses is advocated for the control of intra ocular hæmorrhages both post-operative and metabolic with very successful results.

VITAMIN D IN OPHTHALMOLOGY

Vitamin D is the antirachitic vitamin. It is derived from certain sterols such as ergosterol and derivates of cholesterol by irradiation with ultra-violet light, its formula being (C_{28} H_{44} O (Windaus 1939). It is soluble in oils, fats and waxes; and insoluble in water. Its most potent sources are:—Codliver oil, and halibut liver oil. As for its general role and uses it influences greatly the metabolism of calcium and phosphorus, and aids in the proper

utilisation of calcium and phosphorus, in bone and tooth structure. The therapeutic efficiency of vitamin D in ophthalmic practice is mainly dependent upon its effect on calcium metabolism. The chief ocular conditions in which vitamin D therapy is indicated are (1) Myopia and (2) Keratoconus. In the treatment of myopia this vitamin is employed with a view to stimulate the calcium metabolism which would cause an increase in the quantity of calcium in the sclera and thereby prevent further stretching.

The other ocular conditions in which vitamin D is indicated is Keratoconus. (A. A. knapp) and spring catarrh (Bidyadhar 1941). According to the observations of A. A. Knapp (1939) and others the use of vitamin D complex has a definite place in the therapy of Keratoconus.

Chemotherapy in Ophthalmology

BY

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For many years it has been known that certain chemicals have a profound influence on various parasitic invaders of the human and animal body, e.g., quinine in malaria. Since Ehrlich in 1910 introduced salvarsan for the treatment of syphilis and other spirochætal diseases, a synthetic pharmacology has evolved, transforming the whole field of therapeutics. Chemicals have been recommended for introduction into the body with the object of directly killing various bacteria. Many have not fulfilled their promise, but the introduction of prontosil by Domagk has marked a great advance. Prontosil was found to save mice infected with multiple lethal doses of virulent Streptococcus pyogenes. At first its mode of action was a mystery, but later it was shown to be broken up in the body with the liberation of p-aminobenzene-sulphonamide, which had a definite antibacterial action on this streptococcus. The clinical and laboratory study of p-aminobenzene-sulphonamide, or sulphanilamide, has proceeded rapidly, and it has been shown to have a well-marked curative action on infections by Streptococcus pyogenes, gonococcus and meningococcus and possibly other bacteria, as well as on urinary infections of Bact. coli. Many compounds allied to sulphanilamide have since been prepared. Most of these were ineffective or toxic, but one in particular, 2 (amino-benzene-sulphonamido)—pyridine or M and B 693 (known as sulphapyridine in the U. S A.), has considerably widened the range of action of these chemicals.

This is more effective than sulphanilamide on streptococcus pyogenes and it also acts on many other members of the streptococcal group; and especially on the pneumoccous. This antipneumococcal effect makes it outstanding not only in general medicine, but in ophthalmology.

There is not complete agreement as to the nature of the antibacterial action of a chemical like M and B 693, but certain significant facts are known.

(1) So far all newer compounds of this group which have been shown to be active against bacterial infections contain sulpher.

(2) On certain bacteria it has an antibacterial action in concentrations which can easily be attained by therapeutic administration.

(3) The action is limited to certain bacteria. Some, like Streptococcus pyogenes and some pneumococci, are extremely sensitive; some, like certain pneumococci, are moderately sensitive, and others, like the enterococcus, are quite insensitive.

(4) It is readily absorbed when taken by the mouth and reaches a high concentration in the blood within six hours of ingestion.

(5) It readily passes into the cerebrospinal fluid in marked contrast to many drugs and antitoxic and antibacterial serums.

(6) It is excreted by the kidneys and may be found in high concentration in the urine.

(7) The action is at least as great in the body's fluids as it is in non-albuminous culture media.

(8) In concentration greater than can easily be obtained in the human body it has no deleterious action on leucocytic function.

(9) The action is bacteriostatic rather than bacteriocidal, i.e., the chemical inhibits the growth of the bacteria but does not kill them. These drugs act directly upon the infecting organisms rather than through the defence mechanism of the body; they apparently interfere with the metabolism of the infecting agent, thereby preventing its multiplication and allowing it either to die or to be overcome by the natural defence mechanism of the host.

(10) The apparent action is greatly enhanced when it acts on bacteria in blood with its full complement of leucocytes, which destroy the bacteria whose growth has been arrested by the drug. It follows therefore that the more perfect are these defences—in other words, the higher is the degree of immunity of the individual—greater will be the apparent effect of the chemical. For this reason it is theoretically advantageous to immune the patient, so that when the infecting bacteria are inhibited by the chemical the body may be in the best condition for their rapid destruction.

(11) Lockwood and Lynch have demonstrated that the presence of peptones in vitro decreases the bacteriostatic

action of sulphanilamide compounds, thus indicating that protein—degeneration products may interfere with the bacteriostatic action of sulphanilamide. It is a matter of common clinical observation that in a localized infection with actual tissue necrosis (and consequently an abundance of "peptones") the effect of sulphanilamide compound is less than it is in a widely disseminated infection without tissue damage; it is usually necessary to drain an abscess before infection can be eradicated by the use of sulphanilamide.

At present these chemicals have only established a reputation in the case of infections with very sensitive organisms, but if the basic principles which have been referred to are remembered and the chemicals are given in sufficient amounts at the right time, we may look forward to the scope of these drugs being greatly enlarged. There is no hope, however, of obtaining benefit in the many cases of infection by microbes which are quite insensitive to the drug. In most cases the sensitivity of a microbe can readily be tested in vitro, and if such tests were carried out these chemotherapeutic drugs would not be used indiscriminately and there would not be so many disappointments.

Dosage.—A comparatively low concentration is required in the blood between 3 and 5 m.g. per hundred cubic centimeters maintained for about three weeks, dramatic improvement is soon seen. Different persons give different degrees of concentration with the drug, so that it is well to control the dosage by analysis of the blood. A safe dose rule to follow is $\frac{1}{3}$ grain of sulphanilamide for each pound of body weight in three or four divided doses daily, for the first week and as soon as these symptoms are ameliorated $\frac{1}{4}$ gr. for the remaining two weeks. The drug is best administered with equal quantity of soda bi-carb. If necessary the dose can be increased to the daily intake which will maintain a level of approximately 4 to 6 mg. per hundred cubic centimeters of blood. Slightly lower level should be maintained if sulphapyridine is used. Sulphathiazole recent therapeutic drug introduced is absorbed and excreted rather rapidly and is less toxic. In employing the dosage suggested it is important to have the patient drink plenty of water (about 2500 c.c. per day for adults). Actual blood levels should be determined in the event there is renal damage to guard against an undue retention of the drug.

Toxic reactions.—Although sulphanilamide and sulphapyridine are therapeutic agents of great value, they have toxic

effects of varying importance which are dependent to a considerable extent upon the blood level maintained. Among the most serious are those associated with hemopoitic system, namely, hemolytic anemia and agranulocytosis. The development of morilliform rashes and fever is less serious. Most toxic reactions to sulphanilamide are relatively mild and many patients get them during the first few days of the therapy. They include nausea, vomiting, headache, excitement, vertigo and gastric disturbances. Certain of the reactions appear to be direct toxic effects of the drug, whereas others such as hemolytic anemia and agranulocytosis are regarded as idiocyncrasies, their appearance have little relationship to the daily dosage of these patients. Ample warning of toxic reactions is usually provided by chemical alertness and frequent examinations of the blood, so that when the first signs of toxicity appear, the drug can and should be withdrawn immediately thus checking further destructive action.

SYSTEMIC CHEMOTHERAPY FOR OCULAR INFECTIONS

The most important sulphanilamide compounds in use at present for eye affections are sulphanilamide, sulphapyridine. and sulphathiazole. They are used in following eye infections with more or less success.

Gonococcal conjunctivitis (*Ophthalmia*).—From the several reports published in the literature it can be stated that with adequate chemotherapy nearly all patients with gonococcal conjunctivitis exhibit a clinical and bacteriological cure within one to four days. The results of such treatment in a number of patients in the Hopkins Hospital have been uniformly excellent. However it is now known that sulphapyridine is more effective than sulphanilamide against almost all strains of gonococci, and recent evidence indicates that sulphathiazole is even more effective than sulphapyridine. Some cases resistant to sulphanilamide clears promptly with sulphapyridine.

Sulphapyridine is now used routinely in many clinics for gonococcal conjunctivitis, and is given in approximately the dosage indicated above. In order to insure against recurrences it is not necessary to continue the drug more than 3 days after obtaining the first negative smear.

Rein and Tablets had good results with the local use of sulphanilamide in gonorrhoeal ophthalmia. If *gram* negative intracellular diplococci are found the case is classed as

gonorrhoeal ophthalmia and the patient is admitted to the Hospital and provided with a special nurse. It is the duty of the special nurse to irrigate the infected eye every fifteen minutes night and day with a 0·5 per cent solution of sulphanilamide made up in normal saline solution. In cases with other gonorrhoeal complications for example vaginitis or urithritis—a supplementary dose of 30 to 60 grs. is usually given orally according to the age and weight of the patient. They have been able to get remarkable results with the treatment.

Trachoma.—According to findings of Loe sulphanilamide effects arrest of Trachoma in about three weeks. Thereafter the improvement is said to continue without further medication. He treated with a dosage sufficient to maintain 3 or 4 mg. per cent and reported 100 per cent cures, no other form of treatment being necessary. Essentially same results were reported by Gradle by Kirk and his co-workers and by Richards and his co-workers. Hirschfelder however observed no marked effect on the follicles of early cases, but had marked good effect on trachoma stage second with sacculence. Cases belonging to this group showed improvement after treatment with sulphanilamide. The most outstanding subjective symptom was a diminution of epiphora, which was noticed on the second day after beginning medication. A few days later, blepharospasm, photophobia diminished and vision improved. Objectively the conjunctiva looked drier and paler and the granules decreased in size. The velvety appearance was diminished on the sixth day. On the seventh day the presence of normal blood vessels were observed on the conjunctiva over the tarsal plate of the upper lid, a region which showed the first and most marked signs of objective improvement. The vessels of the pannus become thinner and less distinct on about tenth day after the treatment was begun. About 75 per cent of the patients of this group felt unquestionable improvement in their eyes. Trachoma third stage also showed improvement, their lids looked paler, smoother after a course of two weeks and vision improved due to a clearing of the pannus. In this group the sulphanilamide seemed to moderate the course of the disease and to bring it closer to stage four. In malignant forms of trachoma who suffered repeatedly from flare-ups whose vision was poor and whose conjunctiva was dark red, hypertrophic and smooth and the tarsus was very markedly thickened and deformed due to scars and the pannus thick, these patients with malignant type of trachoma showed from a very slight paling and their subjective symptoms and

objective findings did not show great change. His patients received $\frac{1}{3}$ gr. of sulphanilamide a day per pound of body weight for a period of one week. In the second week the dose was reduced to $\frac{1}{4}$ gr. a day per pound of body weight. Julianelle and his co-workers later obtained relatively poor results in 113 patients with all types of trachoma, still using the safe dosage used by Loë. In brief, Julianelle reports that only 20 per cent of his cases were cured and an additional 40% improved the best results being obtained in long-standing cases with exacerbations. Spinning thought the results obtained in his small series were due principally to an effect of the drug upon secondary infection. In Julianelle's cases, however, the cases without secondary infection were benefited as frequently as those with secondary infection and the results leave little room to doubt that sulphanilamide has a direct effect on the trachoma virus. Thygeson reported 31 cases of trachoma treated with sulphanilamide, 16 patients were healed, 11 showed satisfactory improvement, and 4 with late cases exhibited little or no chance. Thygeson believes that a treatment period of two weeks with a blood concentration of 5 mg. per cent or higher is sufficient to arrest trachoma, while low-dosage treatment, maintaining an average blood concentration of 3 mg. per cent, requires about five weeks to effect a cure. Both Julianelle and Thygeson found that inclusion bodies invariably disappear during the first several days of therapy. Two or three points draw our special attention in the treatment of trachoma with sulphanilamide. First thing is the rapid disappearance of the subjective symptoms, secondly, the conjunctiva looks thinner and paler after treatment and on it are often seen the normal blood vessels. Thirdly, the great improvement in vision due to clearing of the pannus, the vessels of the pannus become thinner and less distinct. A conservative opinion at the present time would be, that the sulphanilamide compound cause disappearance of the non-specific symptoms of trachoma and the improvement of varying degrees in their clinical condition whether it can completely arrest the disease and prevent recurrences remains to be established.

Inclusion Blennorrhea.—The report of the Thygeson indicates that inclusion blennorrhœa responds to sulphanilamide therapy equally well with trachoma. Thygeson has now treated 14 patients of this disease with sulphanilamide, and has observed prompt clearing in every instance, with disappearance of the inclusion bodies on about the third day of the therapy. Two patients in the Wilmer Institute have been similarly treated with equally good results.

However it is doubtful that the use of sulphanilamide is justified in this rather benign disease except as a part of a general investigation.

Streptococcus Infection.—Sulphanilamide remains the drug of choice for B hemolytic streptococcus infections, although sulphapyridine and sulphathiazole are about equally effectual in the same blood concentrations. In the nine cases (two purulent panophthalmitis, five infection of lids or orbit, and two corneal ulcers) of infection with this organism in or about the eyes which have been treated at Wilmer Institute with this drug, the dramatic results were obtained in every case.

Staphylococcus infection.—We have not been able to get as yet satisfactory results in staphylococcus infections with chemotherapy agents.

Koch Week's infections.—The cases that are reported of Koch Weeks infections, sufficiently severe to warrant systemic chemotherapy have all been rapidly cured with the drug.

Meningococcus infections.—Meningococcus infections respond well to sulphanilamide, but probably somewhat better to sulphapyridine.

Pneumococcus Infections.—Pneumococcus infections in general are benefited only very slightly by sulphanilamide, but respond somewhat better to either sulphapyridine or sulphathiazole. Rapid recovery is obtained in purulent conjunctivitis with sulphapyridine. According to some workers the corneal ulcers respond very favourably to the treatment with sulphanilamide but sulphapyridine gives better results in such cases, since the microorganism responsible is nearly always pneumococcus. According to other workers, the action is not definitely established as in such serious conditions we have often to use local treatment.

Pyocyaneous Infections are not amenable to sulphanilamide even with high blood concentrations.

In Infections of unknown Etiology.—Where it is not possible to determine the cause of the infection, the sulphanilamide or better still sulphathiazole is the best drug to use.

SUMMARY

(1) Actions of sulphanilamide compounds are explained and enumerated.

(ii) A simple scheme of dosage is given.

(iii) The toxic reactions of sulphanilamide compounds are given.

(iv) The drugs of choice at present in the treatment of various ocular infections are: (*a*) for gonorrhoeal conjunctivitis sulphapyridine or sulphathiazole is the drug of choice and should be continued for about three days after first negative smear. (*b*) For Trachoma sulphanilamide is the only drug used extensively, (*c*) for beta hemolytic streptococcus infections sulphanilamide remains the drug of choice, although sulphapyridine and sulphathiazole are equally effective. (*d*) For staphylococcus infections, sulphathiazole is the most effective drug at present available, but even this drug is not very effective. (*e*) For pneumococcus infections, sulphapyridine and sulphathiazole are about equally effective. (*f*) For Koch Week's infections, sulphapyridine is more effective than sulphanilamide. (*g*) For meningococcus infections sulphanilamide is quite effective, although sulphapyridine is probably a little better. (*h*) For infections of unknown etiology, sulphathiazole is at present the drug of choice, because it has the widest range of effectiveness. Prophylactic administration of sulphathiazole is recommended in cases of intraocular injury.

Physical Therapy

BY

DR. G. S. GUHA, M.D., D.T.M., *Shillong*

Some of the simple forms of physical therapy applicable in affections of the eye, viz: bandaging, hot and cold applications, are being practised by the general laity from time immemorial. The application of some of these forms of therapy were discovered first as measures to relieve the important symptom of pain in various ocular affections. But one must not doubt that besides relieving pain to a great extent, there is a great factor of healing from these measures.

The author has noticed to his great astonishment that some of these simple but almost indispensable parts of ocular treatment are sometimes being neglected even by the qualified practitioner; eyes have been seen to be lost simply for keeping it unbandaged even after the application of proper medicines in cases of corneal ulcers. It is hoped therefore that a little discussion about these simple forms of treatment will not be in vain.

1. *Bandaging.*

By bandaging, the diseased or the injured eye can be protected from outside effects and infection. Secondly, the process of healing can be aided by keeping the affected eye quiet and in rest especially after injury, operation and ulcer. Simultaneous application of fomentation with bandaging helps in the process of epithelial regeneration. Thirdly, the application of pressure bandage is indicated in bleeding from the eye, in detachments of the retina and in anterior staphyloma. Fourthly, in eyes insufficiently covered by the lids Keratitis Lagophthalmo can be prevented by keeping it bandaged or when the condition has already started in, it should be applied as a part of treatment. Fifthly, as a prophylactic measure in Gonorrhoea, Diphtheria, and small-pox in which one eye is already affected, hour glass bandage or Buller's shield should be put in the unaffected eye as a protection. Lastly, as a protective measure in mechanical works, goggles etc. may be worn. The best means of keeping the affected eye in absolute rest and quite, is the application of a bandage to both eyes whereby the complete loss of movement of both the eyes can be affected, where, however, there is no indication

for absolute quietening of the affected eye, as in superficial lesions of the cornea. a single bandage to the affected eye may be sufficient.

The application of bandage should be carefully done, first by covering the eye with a circular piece of sterile boric lint and over it some sterile cotton wool before putting on the bandage. In sensitive patients and in old people, it is advisable to apply Borovaseline on the skin of the lids and of the surrounding parts of the eye. In restless children, it is advisable to put adhesive plaster above the cotton wool instead of a roller bandage.

Harmful effects of bandaging are:—

1. In sensitive persons, the bandaged eye may become very sensitive even to the lightest pressure of the bandage.

2. In old people, prolonged use of bandaging may produce entropium of the lower lid.

Contra-indications to eye bandaging are:—

1. In conjunctivititis. 2. In Dacrocystitis.

In some of the above named affections, when other complications are present and in which the keeping of the eye in absolute rest is indicated, a light bandage or a capsule bandage or a celluloid bandage or a metal or a wire bandage may be of great use.

"WARM THERAPY"

By application of warmth to the eye, a hyperaemic condition is brought about to the whole eye-ball resulting in the increase of protein content of the blood and also an acceleration of the absorption process. Owing to superficial position of the eye and owing to its being covered by thin eye-lids, the application of warmth to the eyes is very practicable. Warmth not only brings about the dilation of the blood vessels of the conjunctiva with increased flow of blood but also similar changes to the retinal blood vessels as can be easily seen by ophthalmological Examination.

Different kinds of warm applications:—

1. *Moist warm.*

This can be given by a cloth made in 10 to 15 layers, and soaking it in physiological saline, Boric lotion, pot-permanganate 1/3000 soln. etc.

2. *Linseed poultice.*

3. *Thermophore*—(rubber bag containing warm saturated soln. of common salt).

4. *Electric warm apparatus*—infra-red radiation.

5. *Head light.*

(6) *Diathermy or thermopenetration* :—Here the heating in the tissues is brought about through the introduction of a high frequency electric current against the resistance of tissues of the body. The current has low voltage and high miliamperage but its outstanding characteristics is its extremely high frequency. Owing to this high frequency its passage through the tissues is harmless and painless and without sensation. With the help of the finer electrodes, the temperature of the tissues of the body through which the electric current passes can be brought up to the melting point of the tissues (Electric coagulation). Such an application of diathermy is useful in operation for detachment of the Retina.

"COLD THERAPY"

By application of cold, changes in the bodily tissues are brought about. There is a physio-chemical change in the tissues and so delay in the process of resorption.

By constant and prolonged application of cold, a sort of paralytic state of the tissues is brought about. By stoppages of cold-application at this stage, a secondary widening of the tissues takes place and consequently an increase of blood flow.

Indications :—In painful swellings of the eye as in Gonorrhoeal conjunctivitis.

Methods of Application :—

(1) Moist cold compress. (2) Ice bag.

(3) Carbondioxide snow—e.g., in cases of angoima of the lids where necrotic effect of tissues is indicated.

X-RAY AND RADIUM RAYS

In ophthalmology X-ray and radium rays are used for many therapeutic purposes. The energy of these rays and consequently their effects on tissues are much stronger than other light rays. They bring forth a change in the inner part of the atom and take out the electron from inside the atom. At first the rays affect the muscles of the cell and through that influence the regulation of the permeability of the cell membrane and thus a great change is brought about between the affected cells and

surrounding tissues. The nucleus may show swelling or shrinkage with later Karyorrhexis. During the interval immediately following exposure, the process of cell mitosis decrease or even stop. Unless absolute necrosis is brought about, the injured cell may recover after its injury of its nucleus. Thus one sees the possibility of a strong change which may even lead to the damage of the cells and so there is more danger here than in the ordinary light therapy. One must therefore be careful about the danger of cumulative effect of these rays.

The following differentiated cells are markedly radio-sensitive gland cells, hair follicle cells, young cells, cells about to divide lymphoid tissues and tissue of the embryonic type. It is important to know whether all cases in which radium therapy is indicated responds satisfactorily to it. The result of the treatment depends on the nature of the affection and the state of patient's health.

Indications:—

1. In tumours of the eye-lids and surrounding parts of the eye in superficial situation.

The cicatrization is less and therefore the cosmatic effect is better than those by operative treatment.

2. In chronic affections of the conjunctiva as Trachoma. The opinion however varies in this case.

3. In tubercular iritis a very recent treatment, caution must be practised in the application of these rays in ophthalmic practice as there are dangers to the lens and the Retina. The eye requiring treatment has to be protected by a lead plate or concave shells made with glass and metals as lead, quicksilver or gold and the eye covered with shellack in such a way that the gumma rays can only penetrate the affected part of the eye.

Senile cachetic patients are unsuitable for radiation. Marked infection in and around a tumour lessens its radio-sensitivity and also other factors which decrease the blood circulation.

The duration of the disease in some cases influences the result of treatment as in cases with advanced tubercular infection where there is not much effect from radiation, while in other cases, there is more effective result in the late stages of the disease as in Lymphosarcoma. There is more effective result by radiation in cases of rapidly growing malignant tumours than in slowly growing ones which are rich in connective tissue.

There is a latent period of from 3 to 10 days before the effect of X-ray or radium becomes evident. The effect of X-ray and radium is cumulative. Any form of irritation of the skin of the part which is exposed for radiation has to be carefully avoided. The systemic reaction with symptoms of anorexia, fatigue, nausea, vomiting and prostration, etc. which follows heavy doses of X-rays is called "radiation sickness".

LIGHT THERAPY

By light therapy is meant the application of either the rays of the sun or of other artificial light, which can produce some effect on the living organisms either locally on the affected part or diffusely on the whole body. Both these forms of light are applicable in the treatment of the affections of the eye. These light rays lie beyond the violet end of the visible rays of the spectrum and are therefore called the "ultra violet rays". These rays have short wave lengths. These are slightly penetrating and are absorbed in the superficial layers of the skin. The beneficial effect from these rays is brought about by the activation of the ergesterol lying in the subcutaneous layers of the skin. Besides, the ultra-violet rays increase the general muscle tone. By means of quarty applicators, the ultra-violet rays may be carried to different parts of the eye.

Indications of ultra violet light therapy in ophthalmic affections are:—

1. Catarrhal conjunctivitis.
2. Corneal ulcers.
3. Tubercular Iritis.

The viability of the bacteria are affected more by these rays than the tissues themselves. In addition, there is a stimulation of the cell activity which acts as a defensive mechanism against the infective process. The formation of scars in ulcerative conditions treated by ultra violet ray is proportionately less than by other treatment.

Glass lenses absorb the ultra violet rays and so quarty lenses are used. By application of flouriscine, the effect of the ultra violet rays can be intensified.

*Ultra-Violet Ray Therapy in Eye Diseases

BY

Dr. N. K. BIDYADHAR, M.B., B.S.

Ultra-Violet ray therapy in eye diseases: The curative properties of ultra violet light was known to the ancient scientists of the pre-historic Susrutian period. They accordingly advised treatment of many systemic diseases with ultra violet light therapy.

Sunlight is very essential to the well-being of all living beings, both animal and vegetable. The biological action of sunlight depends largely on its intensity, the power of its penetration and the degree of absorption. It has been experimentally found that in the case of ordinary light, a whole gamut of waves varying greatly in length is present. The visual rays are those which, falling within certain limits, are able to stimulate the eye, these limits being slightly less than 8,000 A.U. for the longer limit and 4,000 A.U. for the shorter one. Those rays whose wave-length falls beyond these limits become invisible to the eye; they are denominated as infra-red rays when they are too long, and ultra-violet when they are too short. The wireless waves are of longer wave-length than the infra-red rays, while the X-rays are of shorter wave-length than the ultra-violet rays. The infra-red rays are also called the heat rays, as they are able to stimulate the sensory end-organs of the skin which respond to heat; while the ultra-violet rays are called actinic rays or chemical rays, so called from their ability to produce certain chemical reactions, and especially those used in photography.

From studies on the absorption of ultra-violet rays by the cornea and the lens, we know that only the longer ultra-violet rays between 3,200 and 4,000 A.U. and that only a part of these, reach the retina, and changes in the retina as a result of absorption of these rays have not been found to occur experimentally. From Birch Hirschfeld's observations we learn, however, that retinal changes were noted in rabbits from which the lenses had been previously removed and that only after a longer exposure than the usual therapeutic dose. Exposure to larger doses of infra-red rays would surely be followed by causation of injury to the retina.

*Reprinted from "The Antiseptic".

Larger doses of ultra-violet rays, passing through the cornea have the same deleterious effects on the epithelium of the lens, as they have on that of the cornea. Incidence of cataract on intense irradiation has been noted in the literature. Scheerer has reported two cases of cataract, developing as an after-effect of photo-therapy as well as rœntgen-ray therapy. It has been shown that the lens can tolerate large doses of ultra-violet light without the development of any lental opacity (Vogt). Lens opacities have, however, been observed in Vogt's clinic as a result of infra-red rays passing through the cornea. The time factor in the occurrence of lenticular opacities after irradiation with rays of various wave-lengths has recently been investigated by Wolfflin (1938). According to the observations of Wolfflin the times intervening between the irradiation and the production of degenerative lesions of the lens are diametrically proportionate to the wave-lengths. Occurrence of lesions after irradiation with infra-red rays may take place within a few hours; after irradiation with ultra-violet rays, in a few days; while after irradiation with short-wave rœntgen or radium, lesions may occur in a few months or years. Duke-Elder rightly warns against the dangers of indiscriminate use of ultra-violet therapy. "In the application of the treatment, however, great care must be exercised and a special apparatus must be employed in order to allow the dose to be graded adequately, and—more important—in order to protect the lens; for, while massive doses of light tend to produce a radiational cataract, smaller doses can undoubtedly induce changes in the proteins of this tissue which render their subsequent coagulation and opacification more easy" (Duke-Elder). The principal maxim that a therapeutist should observe in any technique of local phototherapy is that the rays should be adequately controlled in order that the lens is excluded from their direct attack.

In the application of ultra-violet therapy to the eye, the delicacy and extreme sensitiveness of the organ must be kept in mind and on this account, one should use a lamp, running under constant conditions, in which the intensity and delivery of energy can be correctly gauged and graded. The use of ultra-violet rays, shorter than 3,000 A.U., is indicated when an irritating effect is desired, while waves of longer length are to be profitably employed in order to produce a mild abiotic action. In all cases, the highly dangerous infra-red rays are to be excluded.

The Carbon arc, the Mercury or hot Quartz and the cold Quartz lamps—these are the three main sources of artificial ultra-violet light, generally employed for the purpose of

general irradiation therapy of the body. For local treatment of the eye with ultra-violet light therapy, different types of apparatuses have been designed for use by different ophthalmic surgeons, *viz.*, the Mercury vapour arc slit lamp apparatus with a Quartz lens system (Duke-Elder); the Kromayer lamp, a small Mercury arc in a water-cooled Quartz container with a Quartz applicator (Koeppe); a Carbon arc fitted with a filter of uviol glass and a Quartz lens system, one lens of which is movable, so that a five group of light rays can be focussed on to the corneal lesions (Birch-Hirschfeld). Birch-Hirschfeld used a Quartz cell containing 0·5% Copper Sulphate solution for the exclusion of the infra-red rays. The Birch-Hirschfeld apparatus is very popular in European clinics.

The classical investigations on the treatment of systemic diseases by means of heliotherapy, carried out by Rollier, who exposed his patients to solar irradiation on the high Alps, paved the way for harnessing photo-therapy in the treatment of various eye diseases. Since then, the ocular therapeutists have utilised general light therapy in the treatment of tuberculous eye diseases and phlyctenular keratitis. For the routine treatment of phlyctenulosis, general light baths, provided by the Mercury vapour or the Carbon arc are frequently employed in numerous eye clinics. "The object of general phototherapy is to produce a mild skin reaction, with increase in the bactericidal power of the blood" (Gifford). For the routine treatment of phlyctenulosis, administration of light baths is now a common feature in most of the modern clinics. The technique of photo-therapy as followed in Moorfield's Hospital consists of irradiating one-third of the body surface at every sitting with the Mercury vapour arc, after having ascertained the dose of light capable of producing a slight skin erythema. Such applications are to be repeated on other areas twice or thrice every week. Having administered fifteen such light applications, the therapeutist uses a Carbon arc light, which being richer in long ultra-violet light, possesses a greater penetrating effect. With this light, a course of five treatments is given, supplemented if necessary, by another course after an interval of two to three weeks.

In addition to the special therapeutic efficacy of irradiation in phlyctenular keratitis and tuberculous eye-diseases, general light therapy is also indicated in the treatment of the following ocular disorders, namely, sclerosing keratitis, tuberculous iridocyclitis, tuberculous choroiditis and other eye diseases, associated with general cachectic conditions.

Local photo-therapy.—The principle underlying the local ultra-violet irradiation in various eye diseases is two-fold, namely, to make use of the direct bactericidal effect of the light as well as to stimulate and reinforce the immunological and regenerative processes of the system. The various ocular diseases in which local photo-therapy has been advantageously used are discussed below.

The subject of ultra-violet therapy in the treatment of corneal ulcers has been investigated by numerous eminent authorities, namely, Passow, Schinck, Schwarzkopf, Birch-Hirshchfeld, Poyales, Duke-Elder, Hollos and Linkz, Trovati and others. All varieties of corneal ulcers are favourably treated by ultra-violet irradiation. The chronic, the more severe and the recurrent types of corneal ulcers respond satisfactorily to this therapy. In the case of simple forms of corneal ulcer, healing at once begins to take place without any residual opacity. In case of obstinately severe type of corneal ulcerations, ultra-violet irradiation therapy gives the best results, and is therefore the method of choice.

Birch-Hirschfeld and Hoffmann, Lottrup-Andersen, Arnold, Gilbert, Flaschentrager, and others have all observed the remarkable results obtained by treating hypopyon ulcers with ultra-violet irradiation. Birch-Hirschfeld and Hoffmann have reported that out of 190 cases of all types of hypopyon ulcers treated with light, only 9 eyes were lost—which is an extraordinarily satisfactory result in a disease of the severity of hypopyon ulcer.

In the treatment of dendritic ulcers of the cornea or other forms of ulcer, caused by the herpes virus, local ultra-violet therapy gives the most satisfactory result. According to Stock's observations, such diseases responded well after a single exposure of five minutes to the uviol light; while the observations of Gifford show that in the cases treated with ultra-violet therapy, healing was more rapid and the resulting scar much less dense than in others not subjected to light therapy.

Local photo-therapy has also given good results in the treatment of sclerosing keratitis, as is well known from the observations of Stock, Gilbert, and others. In treating this condition, the Birch-Hirschfeld apparatus with uviol filter is used and a course of light treatments of 5 to 11 minutes, covering the whole lesion, is given either daily or every two days.

Chronic ulcers, associated with a varying degree of keratitis and corneal opacity and often complicated with

iridocyclitis, the deep lesions of corneal acne, recurrent ulcers of the marginal type, cases of mild epithelial dystrophy of the cornea—all these respond very favourably to the ultra-violet therapy.

The observations of Koeppe, Passow, Lowenstein and Duke-Elder show that cases of tuberculous keratitis which have resisted all other forms of treatment are wonderfully cured by ultra-violet therapy.

The therapeutic efficacy of local ultra-violet irradiation is exhibited in cases of very chronic phlyctenular ulcer, occurring in children, with ulcerated, opaque and highly vascularised cornea and accompanied with intolerable symptoms of continued irritation. Ultra-violet therapy is also indicated in the treatment of trachomatous ulcers and in degenerative ulcers, occurring at the site of previous scars.

In certain cases of resistant types of conjunctivitis, ultra-violet therapy may be given a trial with advantage. In blepharitis, which proves refractory to ordinary therapy, ultra-violet therapy may be employed. In the treatment of the diseases of the lids and conjunctiva, the Mercury vapour arc gives satisfactory results, and with the use of this apparatus a greater amount of light can be delivered over as large a field as required; while the Birch-Hirschfeld apparatus is to be advantageously used in treating diseases of the cornea, etc., as this produces no painful reactions of the corneal or the conjunctival epithelium.

Some authorities have advocated local phototherapy in the treatment of the diseases of the inner eye, especially of tuberculous origin—namely, iritis, cyclitis and choroiditis. Local ultra-violet therapy seems to be justifiable in those tuberculous cases in which nodules have appeared on the anterior surface of the iris, provided the beam of light be prevented from affecting the lens.

Recently, Trovati (1939) reported the treatment of some corneal diseases with ultra-violet light. His cases included 5 of scarring from ulcerative keratitis, 2 of interstitial keratitis, 5 of vascular pannus and 2 of disciform keratitis. He administered doses, ranging from 3 to 30 minutes with the idea of provoking repeated, moderate reactions. The local reactions, accompanied by increase in the vascularity already present, resulted in some absorption of the corneal opacity. In some cases, vision remained unchanged, while in others, it improved considerably, in 1 case from 1/160 to $\frac{2}{10}$. Opacity completely disappeared in the two cases of

disciform keratitis. In the majority of cases, from 6 to 9 doses at intervals of 2 days to 2 weeks were administered.

Birch-Hirschfeld (1939) in one of his latest studies on short waves in ocular therapy, reported on the results of his observation in 94 cases. His findings are as follows: Excellent results were obtained in 57 cases; good results in 24; slight improvement in 9 cases, while no improvement was noted in 4 cases. In 3 of the last 4 cases, the disease was glaucoma, while the fourth one was parenchymatous keratitis. Best results were obtained for inflammatory and purulent conditions of the lids and tear sac, superficial keratitis and neuralgias in the region of the trigeminal nerve. Speedy and steady improvement was noted in 3 out of 5 cases of optic neuritis and 15 cases of exudative chorio-retinitis. Short-wave irradiation brought about prompt cure in 2 cases of spontaneous victis; in 6 out of 9 cases of tuberculous iridocyclitis, a very good reaction was obtained and in 3 other cases, response was fairly satisfactory. In cases of vitreous opacity, no uniform results were observed; in 3 cases, the opacities cleared up in a short time; in 3 cases, there was slow response, while in 3 others, the opacities remained uninfluenced. In none of the 94 cases, adverse results were obtained by the author. According to Birch-Hirschfeld, short-wave irradiation produces good results; its therapeutic advantages are that it exercises an analgesic effect and considerably shortens the duration of treatment in cases of inflammatory and purulent disease of the lids, the lachrymal apparatus and the anterior segment of the eye-ball. Satisfactory results are obtained in diseases of the retina, choroid and optic nerve.

Birch-Hirschfeld employed an ultra-therm constructed by Siemens, regulating the dosage in every case, a voltage of 19 being applied for from 10 to 15 minutes as the average dose. He started with a period of exposure of five minutes in extreme cases of the eye disease and in cases of involvement of the fundus.

Short-Wave Therapy in Eye Conditions

BY

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Use of Short Wave Therapy in various acute and chronic inflammatory conditions of the different parts of the body is of comparatively recent origin. Marvellous effects of Short-Wave Therapy in relieving pain and cutting short the inflammatory and septic conditions of various parts of the body induced some ophthalmic surgeons of Western Countries to try this treatment in different inflammatory and septic conditions of the eye. In some cases the results were wonderful. For example an eye which was suffering from severe Irido-Cyclitis with certain amount of pus formation in the Vitreous and which under ordinary treatment would not respond at all but, would result in Panophthalmitis or softening of the Globe and total loss of vision, is seen to be improving marvellously under Short-Wave Therapy and regaining useful vision for the patient. On reading such articles, I was tempted to try this treatment in some intractable cases and so far the results have been very satisfactory.

Eye Conditions for which this treatment is effective: (1) Hordeolum (2) Dacro-Adenitis (3) Abscess of the lid (4) Acute and Chronic Dacryocystitis (5) Blepharitis (6) Intractable Corneal Ulcers (7) Keratitis of various types (8) Iritis (9) Cyclitis (10) Irido-Cyclitis (11) Scleritis (12) Glaucoma-Acute and chronic (13) Herpes Frontalis (14) Hypopyon (15) Lens matter in anterior chamber (16) Neuralgias of Supra Orbital Nerve (17) Optic Neuritis (18) Inflammation of the globe in trephined eyes.

A short description of the apparatus: Usually there are 3 types of short-wave apparatuses, 6 meters, 12 meters and 18 meters. For treatment of eye diseases 6 meter apparatus is quite suitable. The apparatus consists of a fairly large sized box closed on all sides except the top which is perforated. The box shows one wire which is connected with a plug. On switching on the current, white light is seen through the perforated top. There are two other wires which are connected with two electrodes. On one side of the top there is a switch milliampere meter and a volt meter, Turning light, Wave and Voltmeter

regulating switches. Both these meters are meant to graduate the strength and intensity of the short wave. For the eye there is one specially made electrode which is placed under the head in the occipital region. The other wire can have one or two electrodes connected according to the treatment to be given either to one eye or two eyes.

Illustration No 1 shows the apparatus, the position of the patient and electrodes. Illustration No. 2 shows the two electrodes on both the eyes of the patient. I refrain from giving a detailed description of the method to be adopted in giving the treatment. It can best be learnt from some one who has used this apparatus for some time.

How long the treatment should be given? For acute conditions the treatment should be given twice a day for five minutes each time. In chronic conditions the duration of treatment can be 10 to 15 minutes—3 times a week. The intensity of the treatment can be varied according to the bearing power of the patient.

Illustrative Cases: (1) An old man about 65 was trephined for glaucoma a few years back. One day all of a sudden he began to experience severe pain in the eye with practical loss of vision. On examination the lids were found swollen. There was ciliary injection, Cornea was hazy. Anterior Chamber was full of hazy material. Iris patern dull and indistinct. Pupil reaction about the trephine hole looked hazy. On ophthalmoscopic examination one could not go through. Atropine, Dionin, Injection of proteins, Soda Salicylas internally were tried but of no avail. Then short-wave therapy was begun. The first application for five minutes relieved the pain a good deal. Next morning the whole inflammatory condition shows signs of subsidence and the vision which was practically nil began to return. 5 days' regular treatment made the patient absolutely free from pain and the vision returned to 6/60. 10 days' further treatment cured the patient absolutely with the regain of vision to the condition which he had before this attack.

(2) This case was a very complicated and a bad case. She is now under treatment in Bombay. She is an old lady of about fifty years of age. She had some fundus disease and was losing sight gradually. Some ophthalmic surgeon diagnosed the case as Glaucoma and did Iridectomy. The result was loss of vision. Later the patient developed

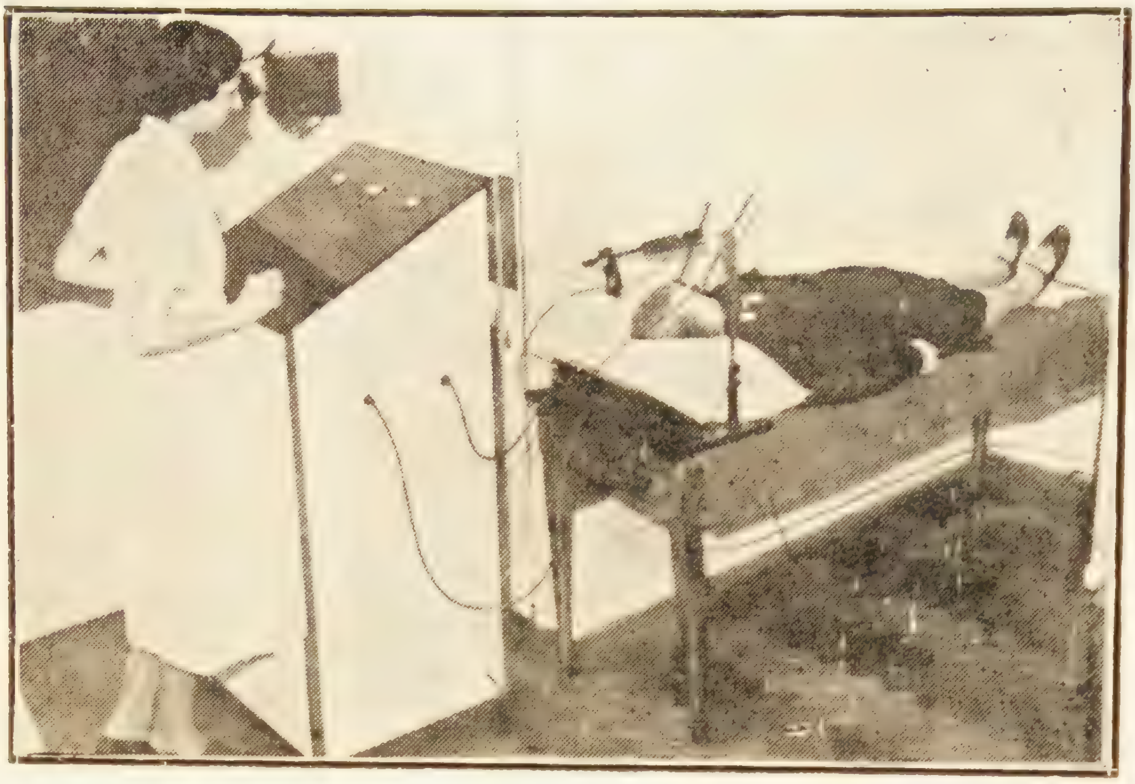

Illustration I

Treatment of the Eyes with short wave therapy

Illustration II

Detailed view of special Electrode and Electrode Holders

Ionic Medication of the Eye

cataract. That was operated too. The result was that the patient developed very severe form of Iridocyclitis or uveitis. When I examined the eyes about twenty days back both the eyes were intensely red, patient was suffering from agonizing pain, and the eyes showed a typical signs of uveitis. The surgeon who operated advised enucleation as the only measure to relieve pain. I too could not see any chance for the poor patient. However I thought of giving trial to Short-Wave Therapy. The treatment was begun and exposures were given for 7 minutes three times a week. I saw the patient two days back and to my great surprise and satisfaction I found both the eyes remarkably better. The inflammation has subsided, ciliary congestion has practically disappeared, anterior chamber is clear and pain is gone. Whether the patient will regain any vision is a question but I have the patient under observation and continued the treatment. I am quite sure that that if this treatment would have been given earlier the patient would have been spared good deal of pain and perhaps would have regained some vision.

I have been convinced that this treatment is a great help to the ophthalmic surgeon. The only point against it is very high price of the apparatus which in pre-war times used to be about Rs. 2,000/.

Protein Shock Therapy

BY

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As the treatment of ulceration of the cornea by paracentesis originated empirically from the benefits noticed in unaided perforation, so also has protein shock therapy sprung from the observation that sometimes an intercurrent infection has a curative effect on an ocular lesion. These infections are nearly always febrile and accompanied by a leucocytosis, two proofs that there is a stimulation of the body's defensive mechanism. A similar upset of the body economy follows the injection of any anti-toxic serum. At the same time there is a very short lived exacerbation of inflammation in the eye, followed by a definite diminution. So in the treatment of ocular infections by shock therapy our aim is to produce as transitory a general upset as possible, with simultaneously, the benefits of the local speeding-up in the eye.

Detailed observation of the general reaction has shown that in about three hours after the injection there is subnormal temperature sometimes accompanied by a rigor and feeling of nausea, and, if the blood is examined a leucopenia. About 12 hours after the injection the opposite state of affairs occurs, a raise of temperature to between 99 and 103 degrees and a mono-nuclear leucocytosis. At this stage occurs the focal reaction in the eye, consisting of an active hyperæmia and lymphocytic infiltration of the Uveal tract. Pain in the eye lasting about three hours may accompany this intensification of the inflammation. Patients vary very much in their response to injections of foreign protein some displaying no fever at all while occasionally there is high fever, delirium and death from anaphylaxis. In infants and elderly people fever may be prolonged sometimes from abscess at the sight of injection but more often from a prolongation of the general reaction. Sometimes, unfortunately an undiscovered tuberculous lesion stimulated into new activity may be the cause of the continuation of the fever. In cases without rise of temperature the degree of shock can be estimated from a blood count. Usually it is safe to reproduce the shock after an interval

of 48 hours but in urgent cases an interval of 24 hours may be risked. Of course, if there is a history of the patient's having had serum or any other form of protein treatment before, it is necessary to test for hypersensitivity by giving a test injection of 1 c.c. of milk an hour before it is proposed to start the treatment. Contraindications to the use of protein shock therapy are chiefly debility, tuberculosis and diseases of the circulatory system. Care should be taken also in prescribing such therapy for patients of an allergic diathesis, such as sufferers from asthma, urticaria, or hay fever.

The degree of shock also depends on which agent is employed. The most generally used and cheapest is whole milk and in Ophthalmology this is practically the only one used. The efficacy of milk as a shock-producing agent depends on its bacterial content; so pasteurized is less effective than the cheaper variety. Boiling for four minutes is sufficient to kill all organisms, likely to cause abscess formation while leaving alive the spore-bearers which give rise to the desired shock. After cooling, the milk is injected intramuscularly in the buttock. The dosage varies with age and weight, 1 c.c. being sufficient to cause reaction in the new born and 8 c.c. in average adult. The second injection is increased in the adult by 2 c.c. or more according to the degree of reaction and is given after 48 hours. Probably three injections give all the benefit possible from this therapy but some clinicians believe in a course of six or more, the maximum dose at one injection rarely exceeding 14 c.c. for the average adult. During treatment the patient is confined to bed and warm glucose is administered four hourly.

There are various commercial substitutes for milk, these preparations being procurable sealed, sterilized, and ready for injection. Probably the best known is Aolan. Then there are cases which do not react to milk at all or very feebly. In the case of adult patients where the need is urgent a reliable brand of T. A. B. vaccine can be used by intravenous injections. The course consists of four injections of 30, 40, 50, 60 million organisms. Only a vaccine of which the bacterial content is known should be used and the dose should be accurately measured and diluted with normal saline in a tuberculin syringe. The average vaccine contains 100 million organisms per cubic centimetre. The time interval between injections is the same as with milk.

Theoretically, any protein foreign to the body can produce shock but the range in practice is very limited.

Good results have been reported from the use of anti-diphtheritic serum in doses of 2100—3200 units every two days. This can be used only in people insensitive to horse serum and here the intradermal test is imperative before the first injection. Lately proteins not foreign to the body have been experimented with in the form of auto-serum or even whole blood. Here there is probably a change in the blood as soon as it leaves the vessels and the new substances formed act as shock—producing agents. The method consists in the withdrawal of 5—10 c. c. of blood from a vein at the elbow and then immediate intramuscular injection of the whole blood or the serum after the clot has settled. Probably there is less fever with this form of auto-therapy but results reported so far are no better than with the much more convenient milk and T.A.B.

The eye lesions for which this form of treatment is most beneficial are those of the cornea and uveal tract. Gonorrhoeal Ophthalmia both in the adult and the new born probably responds more strikingly than any other and in this disease milk has a very good record as a preventative of corneal complications. In other forms of corneal ulceration the results are less certain. For example, in Ulcer Serpens sometimes the condition worsens, with softening and sloughing of the whole cornea, while in others the hypopyon disappears overnight and the case takes a sudden turn towards healing. Sometimes milk is effective in Phlyctenular Conjunctivitis and Parenchymatous Keratitis. Recurring episcleritis and deep scleritis occasionally respond with rapid absorption of the nodule. Any form of Uveitis, including iritis, iridocyclitis, and choroiditis should be given a trial with foreign protein, even though the case is post-operative and perhaps due to the setting free of lens protein. It is also indicated in Sympathetic Ophthalmia with, sometimes, excellent results. Of all uveal affections probably Choroiditis reacts least. Lastly, retrobulbar neuritis especially when associated with nasal sinusitis, sometimes answers quickly to this therapy—and sometimes, does not.

Ionic Medication in Ophthalmology

BY

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Metals such as Copper, Sodium, Zinc and Alkaloids such as Cocaine, Strychnine and Quinine have the power of uniting with acids such as sulphuric, hydrochloric and nitric. The soluble salt thus formed is used for ionization purposes. What is an Ion? When the soluble salt is dissolved in water it is dissociated, that is:

(1) The metal is separated from the radical and the separated particles are, as it were, floating about in water in close proximity.

(2) The original salt was electrically neutral, but the separated components now take different electrical charges the metals taking the positive and the acids the negative.

These electrically charged fragments of acids and metals which are in solution are called Ions (wanderers). Each positive Ion lies in close proximity with the negative Ion in the solution. If, however, a galvanic current is passed through it, the positively charged Ions would migrate towards the cathode, that is, the electrode of opposite electrification and the negatively charged collection of atoms would travel towards the Anode. In other words, the metal Ions which can be said to be the positively charged groups of atoms, run in the direction of the galvanic current from the positive to the negative pole, whilst the acid or the negatively charged Ions travel from the cathode to the anode.

Now we will proceed to examine how the process of electrification is utilized as a therapeutic measure of extreme importance. A single experiment will readily make one understand the meaning Ionic Medication. If one places a pad soaked in strychnine nitrate solution on the shaved skin of a rabbit, and connects the pad with the galvanic current, two kinds of results can be obtained. If the Strychnine solution pad is in connection with the positive pole while the cathode is placed a few inches away, the rabbit would die as a result of strychnine poisoning. However, if the strychnine solution pad is attached to the negative pole and the current is started, nothing results. It can be gathered from the above that the positively

charged Ions of the alkaloid, when placed in contact with the anode, penetrate the skin thereby reaching the circulation and killing the animal. Whereas in the second case, when the cathode is applied to the strychinine solution pad, the strychnine would only remain on the pad and would not enter the layers of the skin. Therefore, we see that the alkaloid has a powerful therapeutic effect when placed under the anode, whereas acids are active only at the cathode.

THE APPARATUS

It consists of a galvanostat or different kinds of galvanic batteries which generate a constant current, and an eye-bath with an aperture at the bottom to admit a small zinc rod about 3 m.m. in diameter which is connected to one of the poles by wire. A blunt padded electrode attached to the other pole of the battery, is best kept on the back of the patient's neck, and held there by an assistant during the operation. The patient sits comfortably in a chair and holds the eye-bath, full of the electrolized solution against his eye, which is kept open throughout. Care should be taken by the patient that his fingers do not come in contact with the zinc rod. The current is then started.

The following salts are commonly used for electrolysis:—Sulphate of Zinc, Common Salt, Potassium Iodide, Soda Salicylate, Copper Sulphate, Calcium Lactate and Quinine Sulphate.

ZINC SULPHATE SOLUTION

R

Sulphate of Zinc	XVIII grains
Glycerine	IV drachms in
Aqua destil Oz.	IX

Zinc sulphate solution is by far the most useful salt in ophthalmic medication and theoretically its anti-septic action is more powerful than pure carbolic acid. It is principally used in Conjunctivitis, Corneal Ulcers, Blepheritis and also in Suppurative Sockets after the eye has been enucleated. Great care has to be taken in applying this solution because of its irritating properties. On the first day, a milliampere current for 1 minute is quite sufficient. The treatment can be repeated every day, increasing the time to 5 minutes, the strength of the current being kept constant. In some cases, even the zinc

rod forming the positive pole can be directly used on the corneal surface. No harm has been known to result during the past 18 years in my consulting rooms, when used in the way described. In some cases of Corneal Ulcers and Blepheritis the results have been very gratifying. When the eye has been enucleated and the socket has been discharging mucus and pus, a stronger current may be passed for a longer time.

COMMON SALT

A 2 per cent solution is used. It is active at the negative pole. It has a mild anti-septic action, and is most usefully applied as a sedative after the application of Silver Nitrate Solution. This salt is driven in at the cathode and a current of 5 or 10 milliampere can be easily used for 5 minutes.

POTASSIUM IODIDE

A 2 per cent solution is used at the cathode. It has all the properties of iodine with the addition of the penetration action of the galvanic current. In healing ulcers, one may apply tincture iodine locally and then start ionization. I have found it useful in Trachoma.

SODA SALICYLATE

A 2 per cent solution is applied under the cathode. A 5 milliampere strength for 5 minutes is generally used. It is of extreme use in Scleritis and in all rheumatic affections of the eye. In one of our cases, I have even found it irreplaceable, everything else having proved dissatisfactory. This salt is highly useful as an analgesic measure.

COPPER SULPHATE SOLUTION

R

Copper Sulphate	VI grains	
Glycerine	IV drachms	in
Aqua destil Oz.	VI·	

Copper Sulphate is applied at the anode and is useful in Trachoma, specially when the Pannus is more pronounced than the conjunctival lesion. If there is any irritation following the application, the treatment must be discontinued. It should be used with caution, the first sitting lasting 1 minute with 1 milliampere current.

CALCIUM LACTATE

A 2 per cent solution is used at the anode. It is useful when the subjective symptom of itchiness is present, e.g., in Spring Catarrh, and Allergic Conjunctivitis. It is non-irritating and can be used even for 5 minutes at 10 m. a. strength. The solution has also an astringent effect and some believe that it lowers the ocular tension.

SILVER NITRATE SOLUTION

This salt is not recommended for ionic medication. It would be too irritating to the eye in a 2 per cent solution and in weaker solutions, it has no effect.

QUININE SOLUTION

A 2 per cent solution is used at the anode. It is extremely useful in Dandriform and Herpetic Keratitis.

To sum up, my conviction is that every ophthalmologist ought to have an apparatus in order to make use of ionic medication. It has its place in all diseases of the outer eye. It is not expected to work wonders every time, but occasionally it will spring the most pleasant surprise. If properly used it should never cause any damage. In my experience Ionic medication has no use in diseases of the inner eye such as Iritis, Cataract, Opacities of the Vitreous.

The ions are only driven into the surface layers of the tissues and though the current may carry a few ions deep down, yet the concentration is too weak to have any great value.

Radium and Roentgen Ray Therapy in Eye Diseases

BY

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We shall very briefly describe the subject relating to the principles and practice of radium and rœntgen therapy in ocular diseases. It is needless to state that these modern therapeutic agents provide very effective weapons in the therapeutical arnamentarium of the modern ophthalmologist for the successful treatment of many eye diseases which usually prove refractory to the usual official modes of ophthalmic practice.

Irradiation therapy for eye diseases is always best performed by specialists in this line of treatment; as for the general ophthalmologist he should be well acquainted with the general principles and practice of rœntgen ray and radium therapy in order that he may best guide his patients as to the advisability of irradiation therapy in cases of eye diseases which are resistant to the general methods of treatment.

General Considerations.—Radium is an element belonging to the strontium-barium group, it forms three important salts *viz.*, the bromide, chloride and the sulphate. It was the famous Madame Curie who first isolated radium salts from pitch—blende in the year 1898; but it was not until 1911 that the radium element was isolated. Radium is always employed in the form of one of its salts or as radium emanation for therapeutical purposes. The modern radium salts that are commonly employed in practice are the sulphate, the bromide and the chloride. The chloride and the bromide being soluble in water are available in hydrated and anhydrous forms; while the sulphate being insoluble is conveniently employed for filling radium applications, as its insolubility is a distinct advantage in the event of any minute perforation occurring in the applicator.

It is a well known fact that radio-active substances are continually undergoing disintegration by giving forth emanations. The emanation forming the first product of radium disintegration is known as radon, which is radio-active gas decaying at a constant rate. The rate at which radium undergoes spontaneous disintegration is such that a given

quantity of radium would be reduced to half its value in 1716 years. In the case of radium emanation, it disintegrates at such a rate that the radio activity of a specimen is reduced to half its value in 3·86 days, to one-fifth in 8·8 days, while only 0·07% remains at the end of 40 days.

It is to be noted that there are three main types of radiations which are of therapeutical importance, namely:—

(1) *The X (alpha) particles,* which are large massive particles, with a positive electric charge travelling at a speed of 15,000 to 20,000 K.M. per second. The penetrating power of these particles is exceedingly small, and their active range is short, they are stopped by a screen such as a sheet of paper. The therapeutic action of these alpha particles is accordingly negligible.

(2) *The B (Beta) Particles.*—These are small particles with a negative electric charge moving with the speed of light at the rate of 186,000 miles per second. They possess greater penetrating power than the alpha particles. They are screened off by comparatively thin layers of various metals such as screens of platinum. Their action on the tissues may be described as indiscriminately destructive, and with the use of unscreened radium, they are instrumental in causing superficial burns.

(3) *The Y (Gamma) Rays.*—These rays do not possess any electric charge but have very high penetrating power. They are electro-magnetic waves very much akin to the ultra-violet and X-rays. The velocity of the Gamma rays is the same as that of light, though their wave length is usually much shorter than that of the X-rays. The Y-rays are the main therapeutic agents employed in radium therapy and they are obtained in a practically pure form by the simple device of screening off the less penetrating types. It should be remembered that any platinum screen would exclude the passage of all X (alpha) particles; a screen of 0·5 M.M. in thickness would cut off 99·6% of B-particles and 6·01% of Y-rays, while one of 0.8 M.M. thickness would eliminate all the B—particles (Duke Elder).

Dosage in Radium Therapy.—The unit of radium emanation is known as the curie and denotes the quantity of gas which is in equilibrium with 1 gramme of radium. For practical purposes the curie being too large a unit, its thousandth part the millicurie—is employed instead. The recording of the radium dosage is usually done in terms of milligramme hours. One milligramme of radium in a

sealed tube is equal to 1 millicurie, and one millicurie is destroyed in 133 hours. Hence 1 millicurie is equivalent to 133 milligramme hours.

Roentgen Ray.—Roentgen rays or X-rays were discovered by Professor Rœntgen in 1895. The X-rays have been proved to be electromagnetic vibrations analogous in character to the heat waves, the rays of visible light and the ultra-violet rays, though of shorter wave length. The respective wave-lengths expressed in terms of Angstrom units are given as follows:—

Visible light—7,200—4,000 A.U.	The shorter the wave
Ultra-violet light—4,000—200 A.U.	length the greater the
X-rays—500—0·06 A.U.	penetrating power.

Dosage of X-ray therapy.—The amount of rays which the skin would be able to tolerate without causing any more reaction than a slight erythema is designated as the 'Erythema dose' or the 'skin dose' which is usually adopted as the standard for the calculation of other doses for application to tumours, etc.

The Pastille Dose.—The well-known fact that undue exposure to X-ray produces serious results upon the skin has necessitated the adoption of some means of gauging and standardising the therapeutic dose in the treatment of lesions of the skin and superficial structures. For this purpose the sabouraud pastile is conveniently employed—this pastille consists of a paper disc coated on one side with barium platino-cyanide. In normal state this pastille is of pale green colour but even exposed to X-rays, it passes through a gradation of tints, till finally it turns brown. The duration and amount of exposure which results in the production of a definite skin erythema, also produces a brown tint in the pastille. This is called a pastille dose, and is adopted as the unit of dosage.

Precautions in the use of Roentgen ray and Radium Therapy.—We must remember that the delicate ocular structures invariably suffer from the harmful effects following irradiation with X-ray and radium therapy. Necessary precautions should therefore be taken to safeguard the organ. It is a well-known fact that the X-rays easily penetrate the eyelids and the cornea and are mostly absorbed by the lens, the untoward result being that the lenses turn out cataractous in most instances. Incidence of cataract following large doses of X-ray in the treatment of carcinoma of the lids or for lupus has been noted in the literature (Gifford and others). Occurrences of cases of glaucoma fol-

lowing irradiation with X-ray has also been reported by some investigators, namely, Stock and others. In this connection it should be noted that "individuals vary greatly in their susceptibility to rœntgen rays, which must be remembered by Birch-Hirschfeld after intensive irradiation of animals and the statement of Rados and Schinz that 150% skin erythema dose was tolerated by the eye without reaction in their cases" (Gifford). Injury to the lids and the cornea, the permanent destruction of cilia—these are the harmful results produced by irradiation therapy administered in the treatment of carcinoma of the lids.

Protection of the globe should invariably be emphasised in the treatment of diseases of the lids or the orbit. For this purpose the use of Miller s lead glass prostheses, covering the cornea like an artificial eye has been advocated (Stock). Another protective device is ROHRSCHNEIDER'S glass reform eye which is a glass shell containing mercury for the protection of the cornea during roentgen ray and radium treatment. Adequate protection of the globe, however, cannot be guaranteed in the treatment of neoplasms of the cornea or bulbar conjunctiva in which case surgery is better invoked. But in case of neoplasms found involving the inner or outer angles or adherent to the bony orbit surgery fails to achieve the desired end. In such a condition the therapeutist should employ beneficially the use of either radium or roentgen ray therapy.

We shall now make a comparative study of the advantages presented by roentgen ray and radium therapy in the treatment of diseases of the eye. In the treatment of small tumours of lids, radium therapy presents greater advantages than roentgen ray. As is known the Y-rays of radium are much more penetrating than X-rays, 10 cm. of lead being required to absorb the former as against 3 to 5 mm. of lead for latter. In practice the small tubes of radium or its emanation may be conveniently embedded into the tumour which would receive the maximum effect of the irradiation. In case of large tumours, radium is generally applied in the form of radium needles or as seeds of the radium emanation, and left in situ in the body of the tumour, until their activity is exhausted. The employment of special plaques or spatulas, with radium held on the surface by varnish with the metal back affording protection to the globe is indicated in the irradiation therapy of the conjunctiva of the eyelids.

It has been observed that certain neoplasms are more susceptible and amenable to radium therapy than to X-ray

therapy. New growths invading the bulbar conjunctiva and the cornea are satisfactorily amenable to irradiation with radium therapy while in the case of neoplasms involving large areas of skin, irradiation with X-rays is practically more effective. In practice radium is uesd either as a surface application or by implantation within and around the area to be treated. Superficial lesions are irradiated by surface applications while deep-seated lesions are subjected to treatment by radium implantation.

Over exposure of the eye to radium radiations and to X-rays is always followed by harmful results. Indeed the ocular complications following radium therapy are practically the same as those of resulting from roentgen ray treatment. Cases of incidence of Keratitis, cataract and glaucoma have been reported after irradiation with radium as well as X-ray (Kumer and Sallmann). According to the observations of Kumer and Sallmann, the dosage of radium which the organ can tolerate with safety is somewhat higher than that of X-rays, 100% skin erythema dose being about the upper limit of safety for one application and 300% for the total dosage divided over a year (Gifford). As the lens is most susceptible to damage by irradiation one must very cautiously gauge the amount of radiant energy delivered to the lens. In estimating and standardising the proper dosage one should take note of the following factors, namely, (1) the radiant energy decreases very rapidly with distance from the source of energy, (2) filtration plays an important part in the delivery of the dosage, (3) individual susceptibility is a third factor which varies greatly in different persons. The observations of Larkin have demonstrated that carefully measured radiant energy delivered to the lens varying from 1½ to 5 erythema doses did not result in the production of cataract in his cases. It has been found that the delivery of a dosage of radiant energy below three erythema doses is safe for the lens. Larkin has shown that 50 mg. of radium screened with ½ mm. of platinum applied for a period of 24 hours delivers one erythema dose. In administering radiation therapy the therapeutist must arrange the application in such a way that six erythema doses are applied to every part of the tumour. In the event of using implants of radium one should remember that one mg. for 120 to 140 hours will successfully destroy an area of malignant tissue 1 cm. in diameter; while in case of implantation of radon seeds, which are radio active emanations, 2 millicuries of radon would effectively destroy an area of tissue 3·5 mm. in radius. The radio active property of the radium

emanation or radon is constantly undergoing disintegration and it is known that the effect of radon continues to be active for a period of nearly 40 days, while 50% of its energy is spent up in four days and 87 to 93% in 16 days.

Having briefly considered the fundamental principles of roentgen ray and radium therapy, we shall now describe the practice of irradiation therapy as adopted for the various ocular diseases involving different structures of the eye.

Diseases of the Lids.—Vascular nævi involving eyelids are eminently suitable for radium treatment in case of capillary haemangiomata, the earlier they are treated with irradiation the better the result. In cases of unusually large xanthelasmata radium is very efficacious while smaller ones are better and more easily dealt with by surgical measures.

Carcinoma of the Lid.—Surgical procedure is adopted for small growths not adherent to the bone where large areas of skin are involved, roentgen ray therapy is applied with benefit. Radium therapy is reserved for cases of growth at the lid border or for growths involving the inner or the outer angle, with adhesion to the bone.

Chronic Dermatitis of the Eyelid.—X-ray application administered in small doses is very effective.

Blepharitis of Resistant Types—Roentgen ray therapy has been found to be highly useful in cases of blepharitis of an obstinate type which is refractory to the usual modes of treatment. In such cases generally 2 or 3 X ray treatments would very often ameliorate a case of long duration.

Dvorak-Theobald and White (1939) have employed radium therapy in the treatment of Chalazion, this therapy being advocated for cases in which operation is either difficult or leaves an unsightly scar.

Recently HAMBRESIN (1939) discussed the use of roentgen ray therapy for the treatment of furuncles and styes. According to his observations X-rays give excellent results in such cases and he also suggests that X-rays would be beneficial in cases of acute dacryocystitis, orbital periostitis and cellulitis of the orbit at best in the early stages of involvement.

Pituitary Tumours.—The problem of irradiation therapy of pituitary tumours is of outstanding interest to the oph-

thalmologist. The adenoma is the only form of pituitary which responds to irradiation. In such cases of tumour, roentgenray therapy in advocated, large doses being directed to the seller region through a number of fields. In case there is poor response to a number of X-ray treatments, surgery should be judiciously employed. The use of radium therapy is prescribed in cases where the tumour has eroded the floor of the sella, or after sellar decompression operation has been done. A trial of deep X-ray therapy is recommended for the treatment of brain tumours which are inoperable and are instrumental in damaging the vision in spite of decompression being carried out.

Intraocular Tumours.—For the treatment of intraocular tumours such as glioma (retinocytoma) irradiation therapy should be judiciously employed. In the case of doomed eye, enucleation followed by radium application in the orbit is absolutely indicated. It is only in bilateral glioma especially where the second eye is much less involved as in sarcoma of the only seeing eye, where enucleation is indicated against by the patient that irradiation should be undertaken (Gifford). Several cases of intraocular tumours treated effectively by roentgen ray therapy have been on record.

Diseases of the Orbit.—Carcinoma of the orbit is amenable to radium therapy, radium needles or tubes of radon being implanted into the growth. In cases of multiple limphomata of the orbit either roentgen ray therapy or radium therapy should be effectively employed. Radium in such cases is applied in plaques over the lids and is attended with better results than that by X-ray therapy.

Diseases of the Conjunctiva.—The use of radium application in vernal catarrh has been warmly advocated by the modern ophthalmologists. It has however its advantages as well as disadvantages. According to Gifford a very definite indication exists for the employment of radium in the treatment of vernal catarrh. A number of these cases are relieved of their troubles and symptoms by intravenous injections of afenil or by desensitisation to some foreign proteins. Others, however, are not so relieved especially the cases with large flat papillae of the upper lid and such cases should be given a trial by radium therapy as many are relieved only by this therapy. Gifford, however, emphasises that this therapy should be reserved for cases with troublesome symptoms which have resisted other forms of treatment.

Quick of the Memorial Institute, having done the treatment of a sufficient number of cases of vernal catarrh by irradiation warns against the dangers following the indiscriminate use of radium therapy. He includes that in spite of good results obtained on account of the dangers especially of the lens inherent in its use radium should be reserved for cases in which all other methods have failed.

Trachoma.—The application of both radium and roentgen ray therapy judiciously employed is recommended in the treatment of obstinate types of trachoma.

Diseases of Cornea.—In the treatment of herpetic keratitis roentgen ray in 30% erythema dose in a course of one or two treatments may be tried. In sclerosing keratitis roentgen ray therapy in 15 to 20% erythema dose, repeated after 7 weeks is to be employed. In such cases a course of 3 to 4 treatments is considered adequate.

Diseases of the Iris and Ciliary Body.—For the treatment of resistant types of tuberculous iridocyclitis, roentgen ray therapy as described for sclerosing keratitis may be given a trial. In the X-ray therapy for these intraocular diseases there is always some risk of producing cataract, as the lens is unavoidably exposed to the X-ray in such cases. After experimenting with graduated doses Scheerer and Stock have fixed 15 to 20% erythema dose, repeated after 7 weeks, as the safest and the most effective dose for therapeutical application.

Diseases of the Choroid.—Radon treatment of secondary carcinoma of the choroid has been reported by the Evans (1938). In this connection the following observations have been recorded by the author—" Radon therapy for secondary carcinoma of the choroid proved clinically effective over a period of 2 years and 4 months. During the major portion of the period good vision was maintained. Ultimately failure of vision was due to intracranial complications involving pressure on the optic nerve.

Lowenstein and Reis very enthusiastically advocate the use of roentgen ray therapy in thrombosis of the central vein. This therapy however is still in the experimental stage and remains to be confirmed by other observers.

The practice of irradiation of the orbit after enucleation of glioma or melano—sarcoma has long been advocated by modern ophthalmologists. According to Gifford irradiation is positively indicated in these cases where careful examination of the enucleated eye, especially of frozen

sections of the orbital end of the nerve in glioma shows evidence of extension into the orbit or past the cut end of the nerve."

Grenz Rays and their Application in Ophthalmology.— A new form of irradiation therapy which has lately been introduced into ophthalmic practice is the use of Grenz rays. These rays were first described and used therapeutically by Bucky, they are very soft roentgen rays with a wave length of nearly 2 to 4 angstrom units, being rays of a wave length situated between the ordinary roentgen rays and the ultra violet rays in the electro magnetic spectrum. These Grenz rays penetrate the superficial layer of most mediums and are absorbed almost entirely in the surface layers of the skin as also mucous membranes, only 12% penetrating deeper than 3 m.m. (Gifford).

As for the biological effects, grenz rays and other roentgen rays are practically the same, with this exception that in the case of the grenz rays, the effects are mainly dependent upon the voltage and on the absorption curve in the different tissue layers. The problem of Grenz ray therapy in Ophthalmology has been investigated by several workers namely, Krasso, Dethmers and Boshoff and others. This form of therapy has been attended with beneficial results, in the treatment of various ocular disorders, namely. Blepharitis, dendritic keratitis, rosacea keratitis, superficial corneal ulcers and sclerosing keratitis.

Some Observations on the Hysterical Manifestation in the Eye

BY

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Hysteria presents such varied and changeable symptomatology, that it sometimes becomes extremely difficult to decide whether such subjects are simulating or are definitely suffering from some organic disease. Again, when the question of giving prognosis, in such cases, crops up, even the clearest heads will think twice before committing themselves to any definite statement. In the midst of such confusing and deceptive symptoms, Charcot, pointed out that the ocular manifestations are singularly constant and characteristic; some are confined to the apparatus of special sense, while others are confined to the motor apparatus of the eye.

HYSTERICAL AMBLYOPIA

In hysterical subjects disturbance of vision is astonishingly variable. Sometimes the vision is partially affected while at other times, peripheral vision may be entirely abolished, perception being limited to central vision, which may extend only upto 5 or 10 degrees from the fixation point. And this may remain so for years. Again, the same subject may show different state of vision at different times of the day. Thus, I remember to have seen a case, whose state of vision at 7 A.M. (early morning) was much better than that at 11 A.M. or 12 Noon. This I think was due to development of spasm of accommodation through the influence of light. Some times, central vision may be affected, when there is complete amaurosis and no light, however strong, elicits visual response. Like cases of advanced optic atrophy, visual insensibility is profound and complete.

In this connection, I remember the case of a married Hindu girl of 18, who came up for consultation in August 1937, for loss of vision in both eyes. Some three weeks before, while lighting a spirit stove which had just gone out, the thing exploded and she sustained an injury on her right eye and lost consciousness. She was promptly attended to by a local doctor. Although there was no injury to the

cornea and other vital structures, the patient could not see with her right eye. Three days after this accident, the girl complained of loss of vision in the left eye (the uninjured eye) and there was extreme hyperæsthesia of the skin over the right half of the face and neck. Later on, this hyperæsthesia gradually began to spread along the whole of the right half of the body. The patient would not allow any body to touch the right side of her body and even the weight of her clothes and under garments were painful to her. She was admitted into a hospital and then discharged after a stay of ten days, without any improvement of her vision. When I first examined the case, there was no visible sign of any disease externally. Fundus examination revealed a normal picture. PR and PL lost completely, yet the pupil was slowly reacting to light. Field examination was not possible. On the 24th day, the girl suddenly recovered her vision and it was 6/6 in each eye.

It sometimes becomes very difficult to say, whether the amblyopia is hysterical or not. We know, the essential sign of hysterical affection, is concentric contraction of the field of vision. This contraction of the visual field, again, depends to a great extent on the amount of light in which the patient is examined Tinted glasses, increase the extent of the visual field.

HYSTERICAL SPASM OF ACCOMMODATION

The following case serves to illustrate the obstinate nature of spasm of accommodation and also the influence of light upon the development of such spasm.

On 10-9-39 a Hindu boy, 14 years of age, was under my care, for gradual loss of vision—vision being F.C. at one foot in each eye at the time of examination. His attending doctor told me, that about one year back the boy had slight accommodative spasm and a slight narrowing of the visual field, central vision remaining almost normal. The attending doctor thought that this slight diminution of the visual field, might be due to an attack of Epidemic Dropsy, which the patient had in 1931. Since then, the boy was rapidly losing slight The patient said that he could not bear strong light which cause headache and pain in the eyes and he felt much better in a dark place. On examining him, I found a spasmodic myopia of 8 dioptres in R.E., and 12 dioptres in L.E., with a visual field contracted to 5 degrees round the fixation point. Under Atropine for one week, I examined him in the darkroom. There was slight hypermetropic astigmatism of 0·75 dioptre; fundus appeared to be

absolutely normal. Vision with proper correction came upto 6/18, but with tinted glass (blue tint used) placed in front of the corrected lense, vision improved upto 6/12 and the visual field also upto 15 degrees. I prescribed Atropine (1%) for a fortnight more, but still the central vision and the visual field did not show further improvement on 2-10-39. Next, in consultation with a senior ophthalmologist of the city, I gave him a course of six sub-conjunctival saline injections every fifth day starting with normal saline and going upto 6 XN. saline, while Ung. Atropine was continued. On 17-12-39, the boy was examined once again, when, with proper correction and tinted glasses vision came upto 6/9 in each eye. I ordered him to put on tinted glasses. Some two months after this, I found the vision improved upto 6/6 in R.E. and 6/6 in L.E. The spasmodic myopia and the field defect had almost disappeared.

Field for colours in hysteria show remarkable changes and sometimes bewildering variations.

Four years back, I had a case of dyschromatopsia under my care. In this case the red field would some times become larger than white or blue fields and at other times practically normal. Excepting this disturbance of the colour fields, my patient (a man of 46) did not show any other hysterical manifestation, though he was a quick tempered subject. Several times I took the form field, but never there was any concentric contraction of the field for white. This fact increased my discomfiture, as I was not sure, whether to diagnose this case as hysterical or not. He was examined by a psycho-analyst one and half year back; who declared the subject to be hysterical.

For the last four years, I am following variations of the colour field as also the mood of my patient, but as yet, have not collected sufficient evidence to declare the case to be hysterical (from the ophthalmologist's point of view).

Susruta's Ocular Therapeutics

In this chapter is given a brief explanatory review on the techniques of special therapeutic measures employed by Susruta in the treatment of ocular affections, namely :— Tarpana mesasure (soothing medicament), Putapaka therapy (a special form of chemo-therapy), aschyotana (Eyelotion), Pariseka (Eyewash), as well as the technique embodied in the preparation and application of different varieties of anjanas.

Technique of Tarpana Measure.—After having thoroughly cleansed the patient's system by emetics, purgatives, errhines, and by venesection, and after the thorough digestion of the food taken, the physician would administer the sedative medicament (Tarpana), either in the forenoon or afternoon, in an auspicious hour of the day. For this purpose, the patient would be laid in a room which is not exposed to the rays of the sun and the blasts of the wind. The room must be so cleansed as not to allow the least particle of the dust to float in the atmosphere. The eye socket of the patient would be evenly coated with powdered Masa pulse (Phaseolus Radiatus) pasted with water, the plastering being smoothly, uniformly thick and compact. After this, a good quantity of the transparent upper layer of ghruta, either alone or in combination with suitable drugs, stirred with a good amount of sterile lukewarm water, would be poured on to the cavity of the eye up to the eyelashes. The duration of retaining the tarpana medicament in the eye cavities varies in different cases—for a period of uttering 500 syllables in healthy persons; 600 syllables in persons afflicted with Pittaja eye diseases; and 1000 syllables in cases of Vataja affections. After this, the medicated ghruta is to be drained out of the eye-socket which will be duly soothed by light compresses and mild fumigation (dhuma).

Period of Tarpana Measure.—Susruta, quoting Jejjatacharya, prescribed one day's tarpana in slightly diseased conditions of the eye; 3 days in moderately diseased state; and 5 days in an acutely aggravated condition of the eye disease.

Indications for Tarpana measure are :—Blurred vision, parchedness of the organ, absence of lachrymation, xerosis conjunctiva, depillation of the eyelashes, hardness of the eyelid, and an acutely diseased condition of the eye.

Contraindications for the tarpana application are the following :—It should not be applied in cloudy day nor

when the atmosphere is very hot nor very cold, it should not be applied to a person afflicted with anxiety or fear.

The symptoms which characterise the satisfactory administration of tarpana are :—Sound sleep, comfortable waking, absence of inflammatory exudation, and clearance of vision, feeling of lightness to the organ, excessive lachrymation, defective or blurred vision, and aggravation of the disease.

Heaviness of the organ; blurred vision, excessive itching, lachrymation and glossiness, and aggravated condition of the eye disease—these are the symptoms of excessive Tarpana measure.

Technique of Putapaka Therapy.—The affected eye is to be compressed before the beginning and end of the therapy. The surgeon should prescribe fumigation of the organ with medicinal drugs at the end of the therapy in a case marked by an aggravation of the deranged humours.

Two pala measures of cleansed and pasted meat and one pala measure of medicinal ingredients are to be intermixed with eight palas (eight pala=half a seer) of liquid from decoctions of triphala etc, and made into a ball which would be duly covered over with the leaves of one of the following viz:—plantain, Eranda (Ricinus Communis), Kumuda (Nymphœa lotus), or padma (Nelumbium specisum). This should again be coated with clay and duly burnt in the fire of catechu wood or in that of kataka (Strychnos potatorum), asmantaka (wood sorrel) etc. or in the fire of dried cakes of cow-dung. After the material has been sufficiently burnt, the ball should be taken out of the fire and its contents carefully squeezed and the liquid extract collected in a sterile vessel. This chemical ingredient is to be poured on the affected eye exactly in the manner of Tarpana application.

Susruta prescribed cold putapaka in Pittaja eye diseases as well as Raktaja ones; while lukewarm putapaka and Tarpana Therapy are advocated in eye diseases due to nervous disorders.

Putapaka measures, as also Tarpana medicament, are of three varieties, according to the characteristic medicinal ingredients they possess, namely, Snehana (oleaginous), lekhana (scarifying), and Ropana (healing).

Indications for the different varieties of putapaka are given below:—

Snehana putapaka is indicated when the diseased eye is very dry; lekhana putapaka, when the diseased organ is

highly congested, painful and vascularised; while ropana putapaka in inflammatory conditions of the eye.

Composition of the different putapakas is mentioned below:—

Snehana Putapaka.—Fleshy meat of animals frequenting marshy places, lard, marrow and fat, and drugs of the sweet group, namely, Yastimadhu. padmakastha (Prunus pudum), Bansalochana (the manna of the bamboo) etc. These drugs, when chemically prepared, would make the Snehana putapaka, which is to be retained for a period of uttering 500 syllables.

Lekhana Putapaka.—Flesh and liver of wild animals such as deer etc., along with drugs possessing scarifying properties, namely, powders of steel, copper, conch-shell Vidruma (coral), Saindhava, Samudraphena (sepia officinalis). Hirakasa (ferrous sulphate), Sauviranjana (antimony sulphide) pasted together with cream of curd. The diseased eye is to be exposed to the lekhana putapaka as long as one would take to utter 100 syllables.

Ropana Putapaka.—This should be prepared from the composition of breastmilk, flesh of wild animals (such as deer etc), honey, ghruta and bitter drugs such as Kantakari, Neem, gulancha (Tinospera Cordifolia), chiretta (Swertia Chirata) etc. This medicament is to be retained in the eye for a period three times that of the lekhana putapaka.

Duration of different Putapaka measures—one day for lekhana putapaka, two days for Snehana, and three days for the application of Ropana putapaka.

During the period of administration of putapaka therapy, the patient should be advised to observe a strict regime of diet and conduct. After the application of tarpana and putapaka to the diseased eye, the patient should be asked not to look at dazzling lights, burning fire or highly resplendent objects. The patient should not expose the eye to blasts of wind.

Aschyotana and Pariseka.—Very much like the putapaka and tarpana therapy. Susruta classifies Aschyotana (Eyelotion) and Pariseka (Eyewash) into three varieties, namely, Snehana (oleaginous), lekhana (scarifying), and Ropana (healing) according to the characteristic properties of the constituent drugs employed in their preparation. The doses of the eyelotions differ in different cases, namely, 7 to 8 drops of the medicinal lotion in lekhana aschyotana; 10 drops in Snehana and 12 drops in ropana aschyotana. The medicinal

constituents employed in the different putapaka medicaments are also used in the preparation of aschyotana and pariseka. The duration of pariseka is double that of the putapaka measure or it should be regularly employed till the duration of the disease.

Susruta prescribed lekhana aschyotana and pariseka in Kaphaja eye diseases, snehana eye-lotion and eye-wash in Vataja affections; while ropana aschyotana and pariseka are employed in raktaja eye diseases.

Technique of anjana Therapy.—Susruta advised application of the different varieties of anjanas, after a thorough purification of the patient's system both externally and internally.

Anjanas are of four varieties according to their characteristic properties, viz.,—Lekhana anjana, Snehana anjana, Ropana anjana and prasadana (invigorating) anjana.

Lekhana Anjana.—This scarifying ointment is prepared by mixing the drugs of bitter and astringent tastes (Haridra, daru haridra, etc. and triphala, nirmali, lodhra etc.) with powdered Samkha (Conch shell), Samudraphena (Sepia Officinalis), marine oystershell, crystal, pearl, lapis lazuli, powdered iron and copper and antimony, etc. The lekhana anjana by virtue of the characteristic properties of its constituents exercises a destructive action on vascularisation as well as a fibrolytic action.

Ropana Anjana—made from drugs of the bitter and astringent tastes with the admixture of a moderate quantity of ghruta. This is therefore demulcent, rufefacient and is most efficacious for healing purposes.

Snehana Anjana.—prepared from drugs of the sweet taste (glycerrhiza, grape, padma kastha etc.) admixed with a sufficient quantity of clarified butter.

Prasadana Anjana.—Equal parts of tagara (Valeriana Hardwicitrii), maricha (piper nigram), Jatamansi (Nardastachyo), Sailaja (Parmalia Perlata), manahsila (realgar) of weight equal to that of all the above drugs, four parts of tejapatra (lourus cassia), Srotanjana (antimony) and yastimadhu (glycerrhiza) double the quantity of all the preceding drugs—all these should be finely pounded and pasted with honey or clarified butter. This anjana is very useful as invigorating to the eyesight.

Another useful ointment which imparts tone and health to the eye is known as Bhadro-daya anjana whose composition is as follows:—Equal parts of Kudha Lappa, (Sausurea

Lappa), sandalwood, cardamom, tejapatra, yastimadhu, snotanjana, flowers of meshasringi (Gymnema Sylvestre), tagara, pearl, coral, ruby, lapislazuli, saphire and gold, flowers of nilotpala (Nymphœa stallata) and Brihati (Solanum Indicum), and kantakari (Solanum Zanthocarpum), Nageswara (Mesuaferrea), root of usira (fragrant grass) pippali, shells of hen's eggs, daruharidra (Berberis asiatica) Haritaki (myrobalan), shells of vibhitaka (Terminalia Belerica), tuttha (Suphate of copper), maricha, flesh of lizard (godhika), and gorochana (Gallstone Bijoor)—all these to be finely powdered and made into an anjana and kept in a gold, silver or horn-made vessel or in a pot made of crystal, lapislazuli or Samkha. This ointment is extolled by Susruta as being a highly invigorating eye ointment.

Recipes of other useful eye ointments are given below:—One part each of haritaki, tuttha and yastimadhu, six parts of maricha, should be pounded and pasted together with cold water and fashioned into a varti (ointment stick). According to Susruta this varti anjana would be efficacious in all sorts of ocular affections.

Srinagarjuna Anjana.—Equal parts of haritaki, amalki (embelica officinalis), and vibhitaka (Terminalia Belerica) Sunthi, pippali, maricha, sodium chloride, yastimadhu, copper sulphate, rasanjana (extract of Berberis asiatica), copper, lodhra (symblocos Racemosa), Vidanga (seed of Embelia Ribes), pundariyakastha (Root stock of Nymphœa lotus) should be finely pounded together and pasted with rain water to fashion into ointment varti (sticks); when this varti is rubbed with breastmilk and applied to the eye, it will cure a case of retinitis.

Chadrodaya Varti.—Equal parts of Haritaki, Vacha (sweet flag), kudha (shusurea lappa)' pippali, maricha, realgar, the shell of Vibhitaka (Terminalia belirica) and Samkhanabhi should be pasted together with goat's milk to form a varti This is very useful in retinitis, night blindness, pterygium and blepharitis.

Anjana for Sirotpata (*Pannus*).—A compound composed of Saindhava salt, kasisa (sulphate of iron) and pasted together with breastmilk should be profitably used as an anjana in pannus.

The therapy of Tarpana and putapaka has been briefly given, they should be used advantageously in most of the ocular diseases, namely, abhisyanda, uveitis, glaucoma, timira etc. The surgeon should exercise due discretion in their application.

Modern Methods of Anaesthesia and Analgesia for Ophthalmic Operations

BY

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In many ophthalmic operations, particularly those of an intra-ocular character, it is generally desirable to have the co-operation of the patient and it is essential that no post-operative after-effects such as nausea, retching, vomiting and restlessness shall endanger the operated eye. It is, therefore, in eye surgery local anæsthesia is preferable to general narcosis except in children.

LOCAL ANAESTHESIA

In ophthalmic surgery local anæsthetics are used both for the purposes of eliminating pain and to prevent the patient damaging his eye by contracting the orbicularis muscle and looking up during an intra-ocular operation. It should be borne in mind that in eye-ball operations, to secure absolute quietness, on the part of the patient, a deep anæsthesia is necessary. Any operation on the eye may be performed with the use of one or more of the following anæsthetics:—

Cocaine	Pantocaine
Navocaine	Holocaine
Butyn	Percaine
Acoin	

COCAINE

Cocaine was the first local anæsthetic introduced in 1884 by Karl Koller. The hydro-chloride is generally used, and the solution should be freshly prepared and should be sterilized by boiling. It is a powerful surface anæsthetic and that is why it is so very popular and extensively used in all eye work in 4 or 5 per cent solution. One drop of a 5 per cent solution anæsthetizes the cornea, the anæsthesia of the bulbar and tarsal conjunctiva is less and that of the iris almost nil. When we wish to have a deeper anæsthesia the instillation must be repeated several times, best four or five times at the intervals of two or three minutes.

Cocaine dries the cornea by diminishing the frequency of winking. Hence we direct the patient to keep the eyes shut after the instillation and from time to time during operation we irrigate the eye with normal salt solution so

as to moisten the surface and wash off the impurities. It has also tendency to dilate the pupil. Recently I have been using Cocaine powder in cataract operations. A little powder is dusted in the lower fornix twice at the interval of five minutes. It gives a deeper anæsthesia than instillation, is very economical and gives better results. I must have used it in about 200 cases but no signs of poisoning are seen so far. The powder should not fall on the cornea, and the eyes must be kept closed after its application.

PANTOCAINE

From the introduction of cocaine in 1884, in the course of about half a century, there was no drug, to replace cocaine. But in 1932 some observers like Marx, Revble, Glees and others made favourable remarks as to the efficiency of pantocaine which should replace cocaine.

Pantocaine is a novocaine derivative readily soluble in water, does not change its nature when frequently boiled and combines well with adrenaline. It can be used with adrenaline solution for instillation anæsthesia in 1 per cent solution.

On instillation into the conjunctival sac it produces a burning sensation and blepharospasm for 8 to 40 seconds, and there is a slight hyperæmia which disappears in 3 or 5 minutes. There is no loss of corneal lustre and the regeneration of the corneal epethelium is not impaired. There is a little more bleeding from the conjunctiva than in cocaine anæsthesia (cocaine being a vaso-constrictor and pantocaine a vaso-dilator) but this may be checked by the use of adrenaline with the pantocaine. In pantocaine anæsthesia, the sense of pressure is abolished so that the weight of instruments is not felt, this and the fact that there is neither dilation of the pupil nor increase of intraocular tension makes pantocaine of particular value in using the Schiotz tonometer and the surgical operations for glaucoma. It should also be used for extraction of foreign bodies from the cornea, and in corneal ulcers during cauterisation.

NOVOCAINE

Novocaine known in America as procaine was introduced in 1905. It is far less toxic than cocaine roughly one-seventh. Its solution can be sterilized by boiling without effecting its strength. It is not irritant to the tissues nor retards the healing of the tissues. It is a vasodilator and in combination with adrenaline is very effective and is used

extensively in eye work in 2 to 4 per cent solution due to its wide range, of safety and surety. In the course of extended experience of several years I have not noticed a single case in which there has been any unpleasant local or constitutional distrurbance. One therefore feels justified in recommending as the safest and most reliable drug for the infiltration anæsthesia.

Novocaine can be administered in the following ways according to the nature of the operation.

1. Instillation of the drug in producing anæsthesia is not satisfactory.

2. Injection under the conjunctiva of 2 per cent novocaine solution produces anæsthesia of conjunctiva, sclerocornea, iris and ciliary body. Painless operation can be done on the styes, chalazia and scraping operation of trachoma after injection into the corresponding fornix.

3. *Tissue Infiltration.*—Injection of varying amounts of 2 per cent novocaine solution into the tissues at the site of the operation is employed for surgery of the eye lids, lacrymal apparatus and orbit. Infiltration of the muscle belly with 2 per cent novocaine solution is indicated for operations on the extra ocular muscles. The combination of adrenaline with novocaine assists the effect of novocaine, prolong their action and reduces its absorption and toxicity. It is not so satisfactory as the nerve block at a site remote from the field of operation.

4. *Retrobulbar Injection.*—The solution is injected directly behind the eye-ball. The ciliary nerves are blocked immediately behind the globe and there is a deep anæsthesia of the eye-ball and orbital structures. This method is used in all intra-ocular operations where deep anæsthesia is needed.

5. *Nerve Block.*—The solution is injected into or very near the nerve or ganglion at a point remote from the site of operation. Such injection produces excellent anæsthesia and the anæsthesia is complete within a few minutes of the injection if made close to the nerve. This technique is superior to tissue infiltration as the method is more efficient, requires less medicine and does not disturb the anatomical relations of the parts.

FASCIAL AKINESIA

One of the greatest advancement in modern operative eye surgery has been the introduction of Akinesia as a

routine procedure in all cases of intra-ocular operations. In intra-ocular operations, where the eye is to be opened by a section, temporary paralysis of the orbicularis occuli is essential, in order to prevent serious damage from squeezing of the lids.

Van Lint was the first to suggest the production of temporary paresis of the orbicularis as a safeguard against involuntary spasmodic closure of the lids during operation. He pointed out that by the injection of novocaine near the terminal filaments of the fascial nerve, it is possible to reduce the power of the orbicularis without completely paralysing the muscle. The point which he selected for the injection was about 1 c.m. outside the point where lines are drawn horizontally along the outer orbital margin would cross. Novocaine 2 per cent with adrenaline is used. About 3 or 4 c.c. is enough. The needle is inserted about 1 centimetre external to the external canthus, and slightly below it, some fluid is injected slightly upwards to catch the nerve supply to the upper fibers of the orbicularis, a little more slightly downwards to catch the lower fibers and the largest quantity with the needle directed backwards and downwards, towards the lobule of the ear, but injected more deeply to catch the diverging fan of fibers of the fascial nerves.

Seventh Nerve Block.—O'Brien describes a method of paralysing the temporo-fascial branch of the seventh nerve as it lies in the upper part of the parotid gland. The zygoma is located and the underside followed backwards to a point just in front of and a little below the external meatus. The patient is then asked to open his mouth and the condyle of the mandible is felt to slide forward. When the mouth is open a depression can be felt under the finger. As the mouth is closed the condyle is felt to slip back; it is over this point and into it that the injection is made. The part of the seventh nerve aimed for, is the trunk as it crosses the neck of the mandible. The needle is inserted directly inwards until the point strikes the bone. This is outer surface of the condyle which is here fairly superficial. About 1 c.c. of 2 per cent solution of novocaine or procaine is injected here and as the needle is slowly withdrawn a second similar amount is forced into the tissues. This method rarely fails to produce complete temporary paralysis of the orbicularis palpebram. Of the two methods for the temporary paralysis of orbicularis, this fascial block method is more adopted as it is quick, decent and more reliable.

Retro-bulbar Injection.—Even repeated instillation of cocaine do not render the iris entirely insensitive and manipulations of the iris are always felt by the patients. It is, therefore, advisable in all operations of the iris to give a retro-bulbar injection. This procedure is particularly recommended for cataract extractions, and for operations for the relief of glaucoma.

In this injection we have in view to produce temporary paralysis of the ciliary ganglion which is situated in the apex of the orbit between the optic nerve and the rectus lateralis muscle and in the lateral side of the ophthalmic artery. It appears sufficient to inject 0·5 c.c. of a 2 per cent novocaine solution with one or two drops of adernaline solution. During the injection it is best for the eye to look down and inwards. A fine straight needle is inserted from outwards and above, through the conjunctiva of the fornix to behind the equator of the eye-ball. Deeper advancement of the needle is unnecessary and more dangerous to the orbital vessels. The injection from outward and above is recommended as that would relax the superior rectus muscle.

HOLOCAINE

We know that the cocaine has a drying effect on the corneal epithelium and it increases the tension in those eyes that are predisposed to glaucoma on account of its mydriatic effect. On account of these disadvantages of cocaine some surgeons use Holocaine hydrochloride. It is a synthetic product. It has the advantage of having no effect on the pupil, accommodation or corneal epithelium, and of having antiseptic properties also. It is however more poisonous than cocaine. Usually 1 per cent watery solution is used which produces anæsthesia in about one or two minutes, the effect lasting about 20 minutes Unlike cocaine it produces hyperæmia of the conjunctiva. It is particularly used in taking tension in glaucoma cases. It is not suitable for infiltration anæsthesia due to its toxic effects. It is a costly drug.

BUTYN

Butyn is a coal tar derivative. It possesses some advantages over cocaine. It has no unfavourable influence on the corneal epithelium and does not dilate the pupil. Similar to holocaine it produces a slight congestion of bulbar conjunctiva when combined with adrenaline this inconvenience is overcome. For surface anæsthesia one

instillation of a 2 per cent solution is all that is necessary. Sufficient anæsthesia in this way is produced for removing superficially located foreign bodies of the cornea, for tonometric measurements and as a preliminary to the use of irritating applications. For deeper anæsthesia repeated instillations are required. It is not used for infiltration anæsthesia.

PERCAINE

Percaine forms colourless tasteless crystals easily soluble in water and alcohol and may be repeatedly boiled for sterilization. Its action is more powerful than novocaine. Though it is more toxic than novocaine, its minimal effective concentration is about one fourth, and hence the question of toxity does not come into consideration. It is used in concentration of 1 in 500 to 1—1500 with adrenaline. It has no irritating effect on the tissues, no after pain due to the longer effect of the drug. It can be used for fascial akinesia, and when 2 c.c. of the solution with adrenaline is injected, anæsthesia develops in 2 to 5 minutes and lasts for about 3 hours. It is a toxic drug and cannot surmount the wide range of safety of novocaine.

ACOIN

This drug is related to caffein and theobromen and is an active local anæsthetic in un-irritated eyes in solutions 1:100 to 1:300. It has no effect upon accommodation, the size of the pupil and does not increase intra-ocular tension or cloud the corneal epithelium. It has analgesic effect so it is generally used to prevent the pain of sub-conjunctival injections.

INHALATION ANAESTHESIA

Inhalation anæsthesia has certain disadvantages in ophthalmic surgery, the chief of these being the induction of some degree of vascular congestion, post operative nausea, vomiting and restlessness. Still we have to use it at times particularly in children, nervous patients and in acutely inflamed eyes.

It is used in most cases of acute glaucoma and occasionally in enucleations, evisceration or in advancement of muscles. The surgeon must decide between chloroform and ether. Chloroform is good for ophthalmic surgery in the hands of skilled administrator but the ether is safer. The mixture of chloroform, ether and alcohol is safe and useful.

BASAL NARCOSIS

Pantothal Sodium and Evipan Sodium

Perhaps most ophthalmologists have felt at times the need of general anæsthesia other than that produced by inhalation even in those days of such effective tissue infiltration and nerve block methods. This is particularly the case in connection with operations which necessitate surgical interference with inflamed and conjested tissues or unavoidable drag on muscles and more so in children than in adults. Two methods appear to be particularly suited to our hospital practice either the use of Evipan Sodium or Pantothal Sodium and avertin. Pantothal Sodium and Evipan Sodium are rapidly acting barbiturates. Evipan Sodium has received extended trial in ophthalmic surgery and Pantothal Sodium is now under review and for the following reasons will, I think, prove to be the more satisfactory of the two. The introduction of the anæsthesia is smoother and more rapid with Pantothal Sodium than Evipan Sodium. Muscular tremors, sneezing, jactitation, head raising, coughing and laryngeal spasm are complications which occur not uncommonly during Evipan anæsthesia and so may seriously menace the safety of the eye, whereas with Pantothal Sodium those unpleasant events are very rare, but according to the literature may be induced if the operation is started before complete anæsthesia has been secured.

With pantothal sodium the fall in blood pressure is less than with evipan sodium but the respiratory depression is greater; relaxations better; anæsthesia is longer; the required dose is less than with evipan sodium; recovery is quicker: the mind is clearer afterwards and the elimination of the drug is more rapid.

Pantothal sodium is a lemon yellow powder put up in ampoules of 0·5 to 1 gram and when mixed with 10 c.c. of distilled water or sterile water a 5 per cent or 10 per cent solution is made. Its chemical composition is sodium ethythioburbiturate and is one of the light series of barbiturates. When the solution is first mixed it evolves a gas smelling of sulphuretted hydrogen. The solution is allowed to clear and before injection it is important to see that there is no precipitate.

Technique of Administration.—Three quarters of an hour before the intravenous administration of pantothal sodium a subcutaneous injection of heroin 1/12 gr. and atropine 1/100 gr. is given to adults.

It is essential to have oxygen and carbon dioxide which may be used under pressure in the event of severe respiratory embarrassment and also an injection of coramine 5 c.c. or more, may be necessary for intravenous administration. A good airway is necessary, and for this purpose a Hewer's oral prop is inserted and a nurse or theatre attendant should be instructed to keep the lower jaw forward throughout anæsthesia.

The 5 per cent solution gives a smooth induction and the 10 per cent solution is favourable for the maintenance of anæsthesia. The injection must be made smoothly and not in jerks, and at the rate of 2 to 3 c.c. in the first 15 seconds, then a pause of 30 seconds should be allowed to observe the effect of this. The patient is engaged in conversation from the time of the injection, and unconsciousness generally occurs in 15 to 30 seconds. The remaining solution is injected cautiously until the required depth of anæsthesia is reached and an average rate of 3 to 4 c.c. in 30 seconds. A single injection is sufficient for an operation of 10 to 20 minutes duration. The injection may be repeated or given as an intravenous infusion for operation of greater length. The requisite dose varies from 0·25 gram to 1 or 1·5 gram.

During the injection of the first 2 or 3 c.c. the pulse rate increases and gradually loses some volume, returning to normal in a few minutes. Respiration is quiet and depressed and there is slight cyanosis on this account. There is a slight fall of blood pressure early during anæsthesia but this is regained. The intra-ocular pressure falls. This is favourable in glaucoma and for extraction of cataract by the intra-capsular method. The pupil dilates at first and then becomes normal. Conjunctival and corneal reflexes are lost during anæsthesia, but in spite of this I consider that it is safer to use also local anæsthesia, pantocaine 1 per cent for surface anæsthesia, an injection of novocaine and adrenaline into Tenon's capsule and a facial nerve block. During anæsthesia the eyes are central in position and directed slightly upwards. A stitch in the superior rectus tied to a projecting boss or an Arruga's speculum is sufficient to retain the eye in the desired position for operation.

At the end of the operation 5 c.c. of coramine is administered intravenously. In the rare cases of severe collapse this may be increased to 10 c.c. and to stimulate respiration, carbon dioxide is given under pressure or a mixture of carbon dioxide, 5 to 7½ per cent in oxygen. Alpha lobeline 3/20 or 3/10 gr. is recommended as a

respiratory stimulant and is administered intravenously or subcutaneously.

Pantothal sodium is rapidly katabolized in the body and there is rarely a trace of it in the excretions 12 hours after its administration.

Recovery from anæsthesia is peaceful, quiet, and calm. There is very rarely any headache, vomiting, nausea, and restlessness and when these happen it is possible to attribute their occurrence to the premedication. Occasionally there is a slight taste of sulphur.

Contra-indications to the use of pantothal sodium are (1) Children in whom the glottis is narrow and may easily become obstructed. (2) Asthma (3) Hepatic and renal disorders (4) Severe toxæmia (5) Severe anæmia and debility (6) Low blood pressure (7) Shock.

Evipan Sodium.—Evipan sodium has been used extensively in ophthalmic surgery in Great Britain. It seems that many of its undesirable features, such as jactitation, convulsions, and laryngeal spasm during anæsthesia, may be prevented by pre-operative medication with omnopon and scopolamine and by the use of local anæsthesia during operation. However the risks of head raising and sneezing during operation are too serious to take in an intra-ocular operation. Some degree of excitement after operation is not uncommon.

Evipan sodium seems to be less depressing to the respiratory system and also its margin of safety is possibly greater than pantothal sodium.

TECHNIQUE OF ADMINISTRATION

The patient should be prepared as for a general anæsthetic. Death has occurred owing to the use of evipan sodium when the stomach was loaded. Sodium evipan is a Bayer product put up in ampoules of 1 gr. of the powder and 10 c.c. of aqua distillata to be mixed at the time of using.

The freshly prepared solution is given intravenously with a 10 c.c. Syringe at the rate of 1 c.c. per 15 to 20 seconds. The patient is asked to count slowly until consciousness is lost as indicated by the cessation of counting. Most patients lose consciousness after 3 c.c. solution is given on an average in 45 seconds to 1 minute. By the time the patient counts upto 12 or 15 the force of voice becomes less and less audible and he slowly but

steadily dozes off to sleep. Average dose in eye operations is 7 to 10 c.c. of the solution and it maintains anæsthesia for 15 to 20 minutes. The solution can be repeated if the anæsthesia required is to be prolonged. If any additional dose is necessary to bring the patient under, to prolong the anæsthesia, we should not exceed the original estimated dose by more than 2 c.c.

The same precautions against respiratory embarrassment and collapse should be taken as with pantothal sodium.

RECTAL ADMINISTRATION

Avertin, Paraldehyde

Avertin is a white crystalline substance produced by the reduction of bromal hydrate by alcohol in the presence of aluminium ethoxide as a catalyst, thus producing tribromethyl alcohol which with distilled water will form a 3 per cent stable solution at a temperature of 35 to 40 c.c.

Avertin is administered through the rectum. The solution must be freshly prepared as decomposition occurs after 12 hours. The dose recommended is from 0·06 to 0·09 gr. per kilo of body weight. Children and young adults require and tolerate relatively larger doses than the elderly, and this is also the case with powerfully built labourers.

Four and a half hours before operation the bowel is washed out with a simple enema but this may be omitted in an emergency with no lack of success. One hour before operation a subcutaneous injection of morphine 1/6 to 1/4 gr. and scopolamine 1/150 gr. to atropine 1/100 gr. is given. This is essential for a tranquil anæsthesia in many cases. Half an hour before operation a fine french catheter is passed 4 inches into the rectum and the avertin solution at a temperature of 38° to 40° C. is introduced through this. Absorption is rapid, taking 5 to 10 minutes, so that if the solution is returned another dose should not be given for four hours.

Narcosis is induced in 25 to 30 minutes and its degree varies with the temperament, sex, age, height and weight ratios of the patient, so that the dose must be adjusted appropriately. The period of narcosis varies from 15 minutes to 15 hours; an average duration of 0·075 gr. of avertin is 1½ to 2 hours. There is an early loss of conjunctival and corneal reflexes, the intraocular pressure falls and the pupil is small. The respirations are shallow,

the rate a little increased, and there is a slight cyanosis. It is essential to supplement the general anæsthesia with local administration of pantocain drops to the eye and novocain injections. In 30—40 per cent of cases, particularly children, young adults, and powerfully built persons, a supplementary general anæsthetic of nitrous oxide and oxygen is necessary.

During operation it is essential to keep the airway clear by holding the jaw forward and a careful watch maintained so that they remain clear throughout the period.

After operation narcosis may persist for 2 or 3 hours, from which the patient wakes and then passes into a deep sleep which may last for 1 to 20 hours. Post-operative vomiting rarely occurs when avertin alone has been used. Restlessness is another undesirable post operative complication, and it occurs in about 25 per cent of cases.

In conclusion it seems that the advantages of the avertin are the painless and comfortable indication; the fall in intraocular pressure and in the blood pressure which may be of value in some operations such as congestive glaucoma: and the deep tranquil sleep that follows waking after narcosis. Its disadvantages are that in a number of cases supplementary general anæsthesia is necessary and that asphyxia and post-operative restlessness are serious menance to the safety of the operated eye.

Paraldehyde.—Paraldehyde, a polymer of acetaldehyde is a colourless liquid with an unpleasant smell. It is probably the safest of the basal narcotics for in normal doses it has no effect on the respiratory centres or the blood pressure.

It is administered slowly per rectum three quarters of an hour before operation with physiological saline. The patient lies on the left side in the semiprone position, a rubber catheter is passed into the rectum about 4 to 6 inches and the buttocks are strapped together.

It has been used as a basal narcotic in ophthalmic surgery and has been tried especially in children, mental defectives and persons whose nervous instability and lack of control may lead to loss of proper co-operation under a local anæsthetic. Its disadvantages are that the reflexes are slightly increased after operation and on waking from anæsthesia the patient may become restless and excited. Delirium has been noted.

Surgical Treatment of Detachment of the Retina *

BY

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In the art and science of ophthalmology, the wonder of the twentieth century is the remarkable development in the "Surgical Treatment of Detachment of the Retina." The pioneer in that work was the late Prof. Gonin of Lausanne, who after years of painstaking research was able to stamp his name on one of the first methods of "surgical treatment of detachment of the retina"; about which he spoke at the Congress at Amsterdam in 1929. His assumption was that the essential lesion in these cases was a tear or hole in the retina; and that the closure of the tear or hole by surgical means was followed in a large proportion of cases by a cure of the condition. The experience of a great majority of ophthalmologists in the United Kingdom as well as on the Continent, *e.g.*, J. Cole-Marshall, Lindsay Rea and Rugg-Gunn in London, Weve in Utrecht, Amsler in Lausanne, Safaar, Lindner and Urbanek in Vienna, Larsson in Stockholm and Terrien, Dolfuss and Wertheimer in Paris, etc., is that the above theory is correct, and their belief is supported by practical experience.

Thus the central point, the be all and end all, in the "surgical treatment of detachment of the retina," is the question of the localisation of the hole, or holes; confirming Gonin's famous watchword, "act according to the tear." Since 1931, this has been ably handled by men like Foster Moore, Shapland. Weve. Amsler and others, expending great imagination and ingenuity. Their work led to the solution of the practical problem, namely, the reaching through the sclera the retinal hole or holes seen by the ophthalmoscope.

Prof. Gonin started the ball rolling in this direction by his original, simple ophthalmoscopic examination to find and determine the meridian of the hole, estimating its distance from the ora in disc diameters to find the latitude,

This method was designed by its pioneer to permit of penetration of the globe at a single precise point by the

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thermo-cautery which he used, to produce the obliterating and adhesive scar. Later on, diverse localising devices were introduced, the main principle of them all is the estimation of the angle of incidence of the beam of light which reaches the hole, and to transform this into precise terms of distances on the surface of the globe. But the presence of a localising device does not absolve an ophthalmologist from the onerous duty of a minute and complete ophthalmoscopic examination. The retinal hole is important, but it is not everything, as has been reiterated by Lindner, in that the operator before interfering should know "by heart" in each case the fundus of his patient.

Now that other methods have been substituted for the accurately localised single cautery puncture of Gonin, *e.g.*, the thin and multiple galvano-cautery punctures of Vogt, the caustic potash of Guist and Lindner, the diathermy operations of Weve, Larsson and Safaar; and very recently still, the cathodal micropuncture of Vogt with very weak current; all of which, in the words of Amsler, are akin to a shot-gun instead of a rifle; the approximate shot of the sportsman, instead of the accurate aim of the marksman.

Thus, while Gonin was aiming at sealing up the hole directly, *i.e.*, occlusion method, others began aiming at seclusion or even exclusion of the whole area of the tear; so, in the light of our common experience and in the present state of our knowledge, it is no longer permissible to operate on a case of detachment of the retina, without considering the hole or holes. Similarly, new methods of localisation cropped up, *e.g.*, observation during operation led to Foster Moore's gold-studs, Arruga's drawing-pin, Weve's perioscope, Vogt's localising diathermy puncture, and the most recent attempts of Majewski and Comberg to localise the hole by transillumination (optical method).

Before dealing with the different methods invented in the past few years, and describing the particular method mostly used nowadays, with its indications and contra-indications, its advantages and disadvantages, it would not be out of place to mention here the subjective symptoms and the objective examinations, as they are of the greatest importance and help in ascertaining the situation of the tear or tears, in using a particular method for the closure of the same and in coming to a prognosis, which is of vital importance to the patient. While noting the subjective symptoms, the history of past injuries is very essential, as degenerative changes and cystic formation in the periphery of the retina are reported by Weve and confirm-

ed by Cole-Marshall, may be caused by them. The earliest symptoms reported by patients are flashes of light, floating bodies, cloudiness of and change in colour vision and in the apparent size and shape of objects, which occur more often in cases of oedema and degenerative changes at the macula. The first loss of visual field, or the apparent position of the floating bodies, often shows or determines the position where the detachment commenced; more so in cases where vitreous hæmorrhage has occurred before the patient is examined.

During the examination, near and distant vision should be tested and visual fields carefully charted. Then the tension noted, as lowered tension renders operative success less likely. Similarly, observe the reaction of the pupil and the degree of dilatation after the instillation of a mydriatic; since poor dilatation not only hinders further examination, but also tends towards a poor prognosis. Examination with plane mirror gives useful information regarding the condition of the ocular media and the position of situation of the detachment. This should be followed by a thorough and careful examination in the dark room of the whole of the fundal area by the indirect method using very strong illumination, *e.g.*, a lamp of approximately 200 candle power with a +20 D instead of the usual +13 D spherical lens as advocated and practised by Weve in Utrecht. During this examination, the practice of making a careful drawing of the inverted image, helps one not only in diagnosis and prognosis, but goes a great way in facilitating the operation. Similarly, after noting the tear, its shape and size, its relation to vessels, pigmented or degenerative areas etc., it is of great help to transpose the same to a special chart of the outer coat of the eye, on which the extra-ocular muscles, venae vorticosae, the positions of the disc, macula and the ora, etc., are plainly shown.

After noticing all the above and making a careful diagnosis, an early operation which gives a good prognosis is performed. The outlook is serious where there are very large or multiple holes. Similarly, it is so in cases complicated with vitreous hæmorrhages, detachment occurring in aphakic eyes, or detachment complicated by secondary glaucoma; but even in such cases a satisfactory result may be obtained.

We will now deal with the different methods of surgical treatment invented in the past few years, and described the one used most commonly.

Great improvement in the surgical treatment of detachment of the retina started with the epoch-making discovery of Gonin, who made use of the Paquelin cautery which was heated to a dull red heat and plunged through the sclera, choroid and retina, at the point corresponding to the position of the tear. Thus, he aimed at a choroido-retinal scar, 3-4 mm. in diameter. Improvements were needed on it, as only one puncture could be made at a time, thus preventing its use in cases with extensive lesions; and also, it required most exacting work in localising and marking the tear. Modification soon followed including the use of fine galvanocautery point, with which surface coagulation could be carried out, or several punctures made, without serious loss of inter-retinal fluid. This has its advantages in certain suitable cases.

Later, some surgeons tried to have plastic choroiditis to seal up the tear or tears by chemical methods; such as, infiltration of a weak solution of potassium hydroxide between the choroid and sclera, or touching the exposed choroid, after making multiple trephine holes, with a stick of solid caustic potash, the excess being neutralised by a 0·5 per cent solution of acetic acid. After this, a drainage of the inter-retinal fluid was effected by puncturing the choroid in a third of the total number of trephines made. (These methods are used nowadays in a few particular clinics only, as they have nothing much to recommend).

Side by side with the above chemical methods was introduced the method of closing the tear by "surgical diathermy". In this, a coagulating current is used, applied either superficially, or by a needle point introduced through the outer coats of the eye. Surface coagulation is applied by a ball electrode, 2-3 mm. in diameter, a fine point, or a blunt point 2 mm. across, attached to a thermocouple which enables the operator to estimate the exact temperature to which the sclera is raised. Inter-retinal fluid is drained by trephining the sclera and puncturing the choroid with a blunt instrument or by the use of perforating diathermy applied by means of a fine Weve or Safaar electrode. The risk of the above method is excessive burning with subsequent vitreous hæmorrhage due to necrosis of retinal vessels, which could be avoided by the careful use of just sufficient heat to coagulate the choroid.

Lately, three other methods have been tried; the first is "perforating diathermy method". In it, the choroid is coagulated without any damage to the retina and with very little damage to the sclerotic; and the inter-retinal fluid is drain-

ed through the diathermy punctures. In the second, *i e.*, the method of "electrolysis", a low tension electrolytic current is used, and fine silvery bubbles are produced in the vitreous, with a little scarring in the retina and the choroid along the path of the electrolytic needle. In the above, the production of the bubbles helps one a great deal in the exact localisation of the tear or tears. Whilst the third method combines the advantages of the above two, namely, the "diathermic" and the "electrolytic" methods. In this, short needles, about 0·5 to 1·0 mm. in length are used with a coagulating diathermic current and coagulation of the choroid is carried on without loss of inter-retinal fluid as the needles used are not long enough to penetrate into the inter-retinal space. This inter-retinal fluid is drained by the use of longer needles, *i.e.*, about 1·5 mm. in length, carrying an electrolytic current and forming the cathode of the circuit. The greatest advantage of this method is that, when the retina gets perforated, the area of perforations immediately gets sealed by the action of the hydroxylions produced; which is a great boon, as most cases of secondary detachments, *i.e.*, detachments occurring soon after operative interference or detachments failing to adhere, or get replaced, are due to these artificial hole, or holes produced during operation as stated by Lindner and corroborated by Safaar, Urbanek, Amsler, Cole-Marshall and others.

Lately, in France, Dr. Dolfuss of Hospitaux de Paris, following Gonin's theory, has found a modification of Gonin's method giving best results and cure in about 86 per cent of cases. In his method of galvano-cauterisation juxta-choroiditis, surface coagulations are obtained by the help of pyrometric electrode of Coppez, which helps to find out the temperature used on the surface of the sclerotic. This temperature should be about 80° C and not beyond, and should be reached slowly in 70—80 seconds After obtaining the surface coagulations with a red hot galvano-cautery point, care being taken not to rupture the choroid, the operation is terminated by coagulations with the help of the perforating electrode, which permits evacuation of the liquid under the retina. This method is preferred by the inventor as the coagulations obtained are found to be more solid and heal up more quickly; consequently, the patient is able to leave the bed soon. Also, it is preferred when the detached retina resists re-application by the intervention and use of other methods. Similarly, as one uses an ordinary galvano-cautery with a very fine point, this technique permits easy control of coagulations by the ophthalmoscope in the course of the operation.

The commonly used method at the present time, both on the Continent and in England, with much success, is a combination of "diathermy" and "electrolysis". The one as advocated by Weve, Safaar and Larsson, the other as invented by Vogt. The pre-operative, operative and post-operative steps which I follow and which were kindly taught to me by Cole-Marshall at the Western Ophthalmic Hospital, London, are as follows:—

The patient is put to bed for a day or two before operation to allow careful and thorough examination of the affected eye. The meridian of the tear is noted and marked with Indian ink on the corneo-scleral junction. To keep the patient quiet and get the best co-operation from him omnopon gr. 1/3 and scopolamine gr. 1/150 are given an hour before the operation. Cocaine is not used, as it affects the transparency of the cornea; instead of which a subconjunctival injection of novocaine and adrenaline is given and dessication of the cornea during the operation is prevented by repeated instillations of normal saline.

Adequate exposure of the area of operation, from the start goes a great way in facilitating the operation, and gives the best results. For this, the conjunctiva and the episcleral tissues are carefully incised in the region of the ora; the recti muscles are then defined, and if necessary divided. This gives a good and clear field, and the position of the ora is then marked with Indian ink; and used as a base line for measuring and marking the limits of the tear. Then the procedure of marking the tear (Fig. I) and sealing it and letting out of the inter-retinal fluid, with diathermic and electrolytic needles is carried on. For this, the selection of the diathermic and electrolytic points depends on the case and the area of the eye involved, *e.g.*, a short needle is used under the recti muscles where the sclera is thin; and straight or curved, long or short, *e.g.*, 0·5 to 1 mm. diathermic points or needles according to the position of the tear. For localisation of the tear, an electrolytic needle 3 mm. long is usually sufficient, unless the displacement of the retina is extreme. For drainage of the inter-retinal fluid shorter electrolytic needles, *i.e.*, 1·5 mm. length are useful.

The position of the tear which has already been noted and marked is surrounded by a barrage of diathermy punctures 2 mm. apart, using a current of about 40 M. A., and they are carried right up to the ora in suitable cases (Fig. II). Localisation of the tear is checked by the introduction of 3 mm. electrolytic needle using a current of about 4 M. A. for 1 second (Fig. III) and an ophthalmos-

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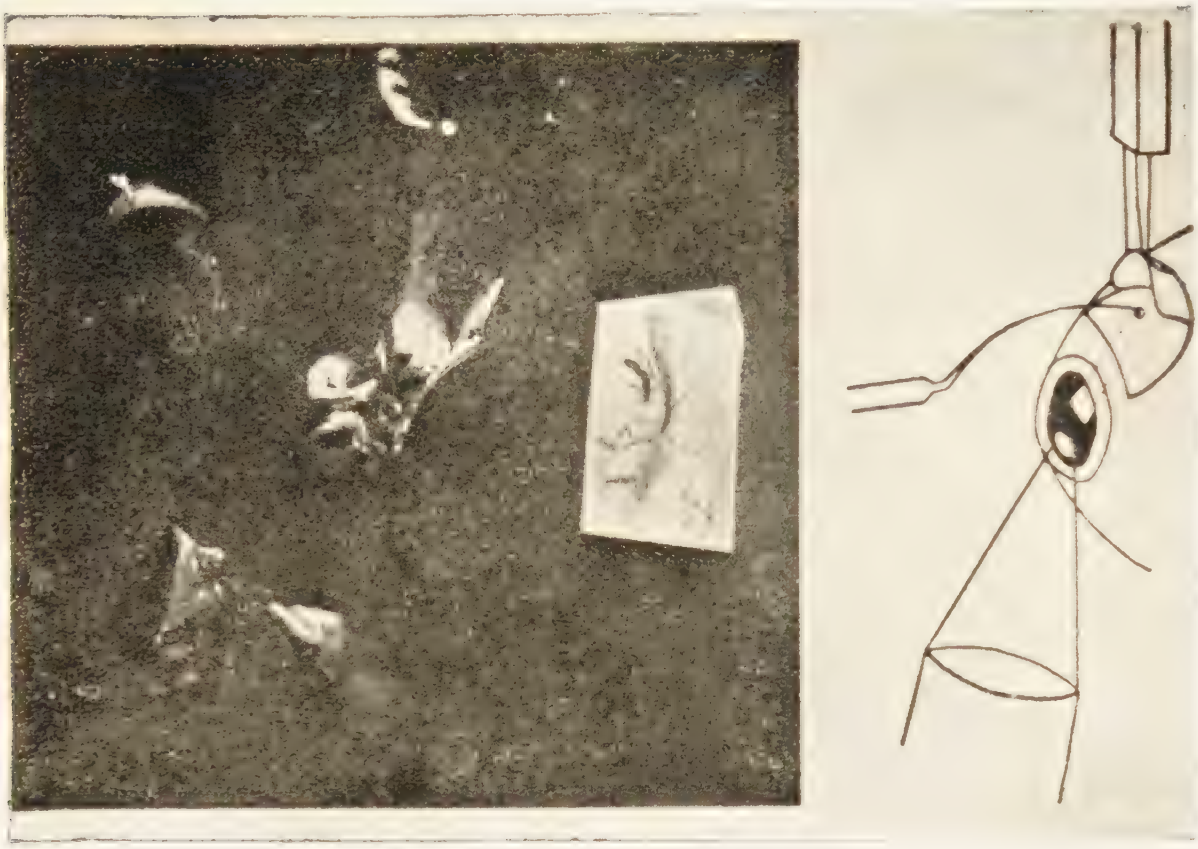

FIG. I

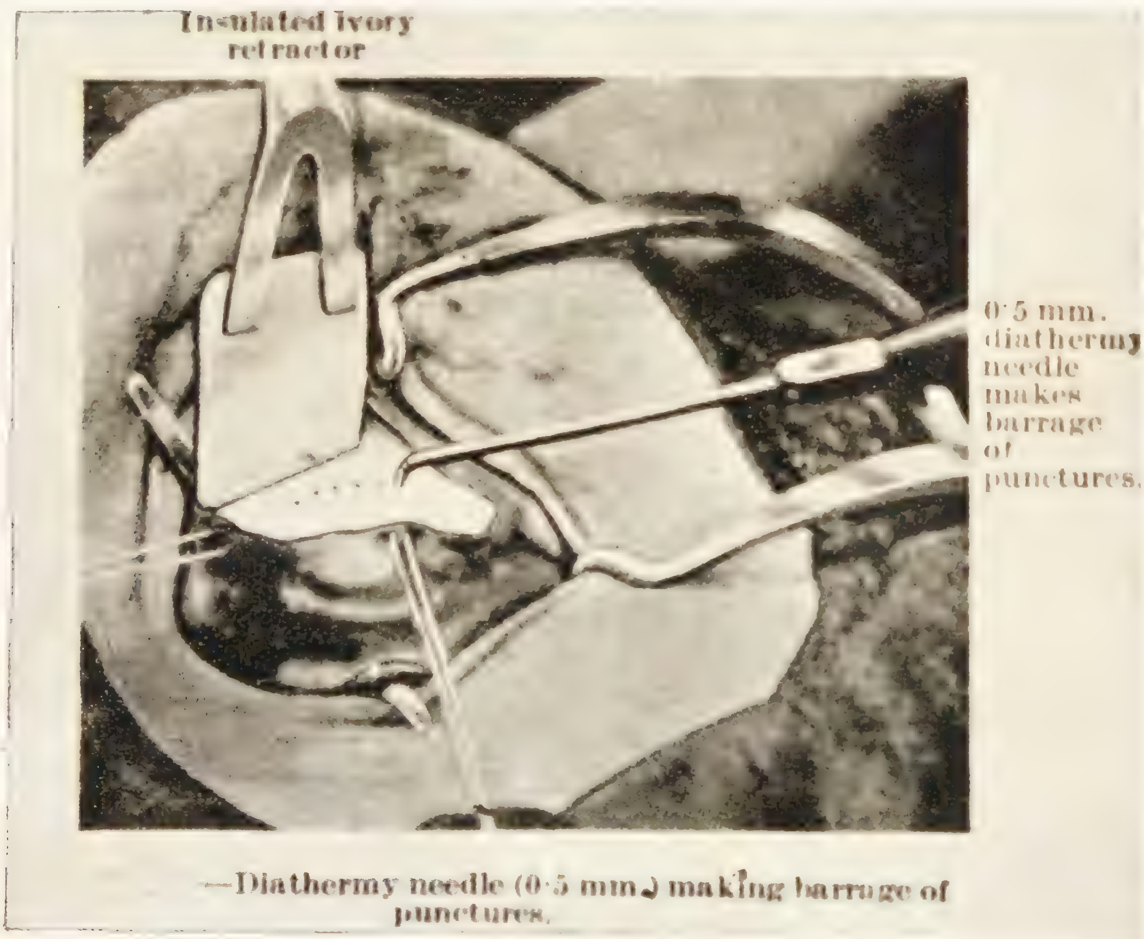

FIG. II

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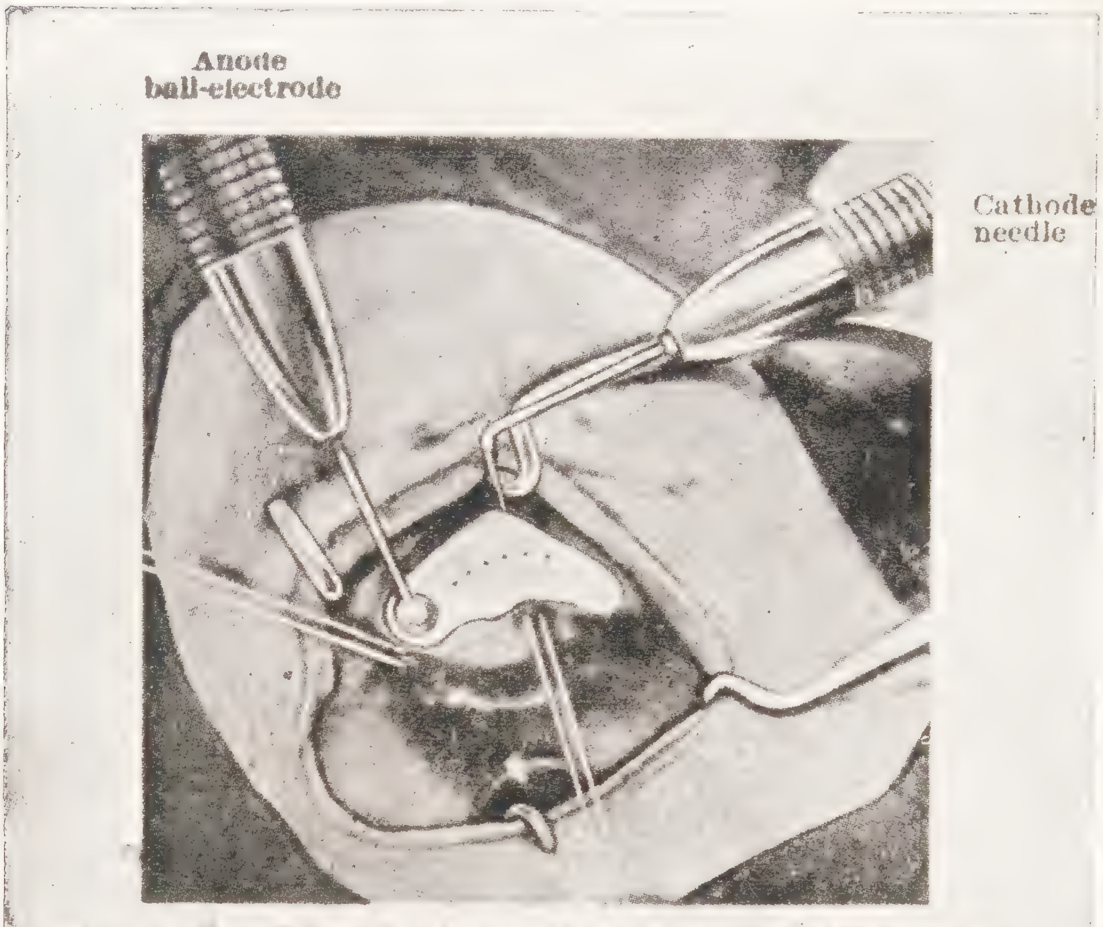

—Localising the tear with a 3·0 mm. cathode needle, using a ball-electrode in anode.

FIG. III

— Appearance of fundus immediately after completio the puncture.

FIG. IV

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FIG. V

Blocks prepared under the direction of
MR. J. COLE-MARSHALL, F. R. C. S.

copic examination is done to note the presence of bubbles in the vitreous (Fig. IV). When these have hit the tear, *i.e.*, when localisation has been accurate, the inter-retinal fluid is drained by repeated puncture with a 1·5 mm., electrolytic point using a current of about 3 M. A. When sufficient fluid has not appeared the drainage may be performed by a thicker needle, or perforation done by a longer diathermy point or the use of a galvano-cautery. Repeated ophthalmoscopic examination during the operation are of the greatest importance, not only in indicating what has been done whether the tear or tears have been properly hit and accurately localised, but in estimating the amount of cure obtained by noting the areas of coagulation and scarring and the amount of reaction taking place because of the operative interference and the result of special operative technique used. After this, divided muscles, if any, and the conjunctival edges are sutured, using catgut suture throughout. Then atropin 1 per cent and argyrol 20 per cent are instilled and both eyes are bandaged with a metal shield (Hess') over the eye (Fig. V).

In the post-operative treatment, the patient is put to bed with his head in such a position that the vitreous presses on the region of the tear. If the patient is comfortable, the first dressing is not carried on until the fourth day; and after this, should everything be satisfactory, the eye is re-dressed every second day. It is better not to make a detailed fundus examination until the end of the first week, as that would involve too much handling and moving about and interfere with the good results of the operation. By the end of the third week, the patient is allowed out of bed. During convalescence, breathing exercises, active movements of the legs, and massage may be allowed, care being taken to avoid excessive exertion.

Summary

(1) Consideration of Gonin's epoch-making work in the treatment of the detachment of the retina.

(2) Description of various methods seen and tired during past six years, *e.g.*, Thermo-cautery; Galvano-cautery with fine points; Injection of Chemical agents; Diathermy surface Coagulation; Perforating diathermy; Electrolysis; and Combined Diathermy and Electrolysis.

(3) Details of Combined Diathermy and Electrolytic method with indications and contra-indications.

* Corneal Grafting

CASE REPORTS

BY

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During recent years much attention has been given to Corneal Grafting as is evidenced by numerous publications. This operation is being performed regularly in the Medical College Eye Hospital as the demand for this operation seems to be considerable.

I am not familiar with the exact methods adopted by other ophthalmic surgeons specially in India. The following is the technique adopted by me in the 5 cases performed during the course of this year. In all the 5 cases the grafts took very nicely, but in two the grafted cornea became opaque, whereas in the other 3 the cornea remained clear and remarkable improvement of vision was noticed.

Choice of cases.—It is desirable that the patient should have a normal anterior chamber and the graft which is to be transplanted should be free from any inflammation. In my cases the grafts were all taken from blind eyes with clear cornea.

Technique of the operation.—The donor and the recipient are prepared in the usual way. Having produced the local anæsthesia and the akinisea they are placed on adjoining tables. The recipient was tackled by myself and the donor by an assistant.

First Stage.—The first stage of the operation consisted in applying stitches to keep the graft in proper position. Two kinds of threads, black and white silk threads, were used. The first stitch was given with a black silk thread at 7-30 o'clock position just off the cornea, taking care that there would be no puckering of the conjunctiva. The free end of the stitch was left in that position and the needle was carried across the cornea obliquely at 1-30 o'clock position where a similar stitch was applied. The needle was then carried horizontally and another stitch was

* Reprint from the proceedings of the All-India Ophthalmological Society, Vol V.

applied at 10-30 o'clock position. The needle was then carried again across the cornea obliquely at 4-30 o'clock position. Fourth stitch was applied at this position just outside the limbus and the thread was carried horizontally to the first stitch at 7-30 o'clock position and another stitch given and the thread placed by the side of the free end of the thread.

Another needle with white thread is applied similarly at 6 o'clock, 12 o'clock, 9 o'clock and 3 o'clock positions and the two free ends were placed side by side, the loose thread lying over the corneal surface free.

Second Stage.—Trephining was done with great caution with the Weiss instrument on the opaque cornea. After a few turns the trephine was tilted on one side so as to cut through one side more than the other so that when the anterior chamber was opened the opaque corneal disc remained attached by a hinge of corneal tissue. The part was then cut very gently with care. The part was then washed with normal saline and inspected.

Third Stage.—The graft which was cut from the donor's eye by the assistant by a similar process was brought over a spoon and placed over the recipient's eye. Having put the graft in correct position the ends of the stitches were drawn and tightened so as to keep the graft in proper position and the knots were applied. Liquid paraffin was then dropped on the eye, which was next bandaged.

After-treatment.—The patient was kept in absolute rest in bed. The bandage was opened on third day and atropine dropped. The stitches were taken out on 5th or 6th day and the bandage was removed on the 7th or 8th day. The patient was then allowed to sit up.

Case 1.—Durgabala Dasi, Hindu female, aged 20 years, admitted on 9-7-36.

Complaint.—Loss of vision in the left eye for the last 2 years.

Previous History.—An attack of small-pox 2 years ago followed by inflammation and ulceration in the R. E.

Condition on admission.—R. E.—Dense leucoma covering the whole cornea. Blood vessels were seen growing over the corneal surface. Anterior chamber and the pupils were not seen.

Tension—normal. Vision—Perception of light only.

L. E.—normal eye. Vision—6/6.

Operated on 20-7-36. Kerato-plasty performed by Dr. Mukerjee.

Donor—Hindu female, 50 years. R. E. Chronic Iridocyclitis, painful blind eye.

Stitches removed on 27-7-36. Graft was kept well in position and was found to be quite clear.

Discharged on 8-8-36. The graft became slightly opaque excepting a clear area in the lower portion.

Vision on discharge—Finger counting at 6".

CASE 2.—Ram Chandra Santra, Hindu male, 36 years, admitted on 22-9-35.

Complaint.—(1) Watering and pus discharge in R. E., duration 4 months. (2) Loss of vision in L. E., 4 months.

Previous history.—Sudden attack of inflammation followed by ulceration in L. E., 4 months ago, followed by loss of vision.

Conditions of admission.—R. E. Regurgitation of pus through puncta on pressing the sac region. Conjunctiva hyperaemic. Cornea clear. Tension normal. Vision 6/6.

L. E. Dense leucoma covering 3/4th of cornea.

Pupil could not be seen. Anterior chamber was normal. Pupil free. Tension—normal. Vision—perception and projection of light present. Treatment—R. E. Lacrymal sac removed on the day following admission, with uneventful recovery.

The patient was readmitted after one year.

L. E. Kerato-plasty was done on 2-10-36 in preference to optical iridectomy.

Donor—Hindu male, aged 39 years. R. E. Absolute glaucoma. Stitches removed on 6-10-36. Graft was in position and found transparent.

Patient was discharged on 15-10-36.

Graft was found quite clear through which pupil could be seen. Vision—6/60.

CASE 3.—Hasan Ali, Mohammadan male, 32 years, admitted on 5-9-36.

Complaint.—Loss of vision in R. E., duration 2 years.

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Fig. I

Case No. II

Before

Case No. II

After

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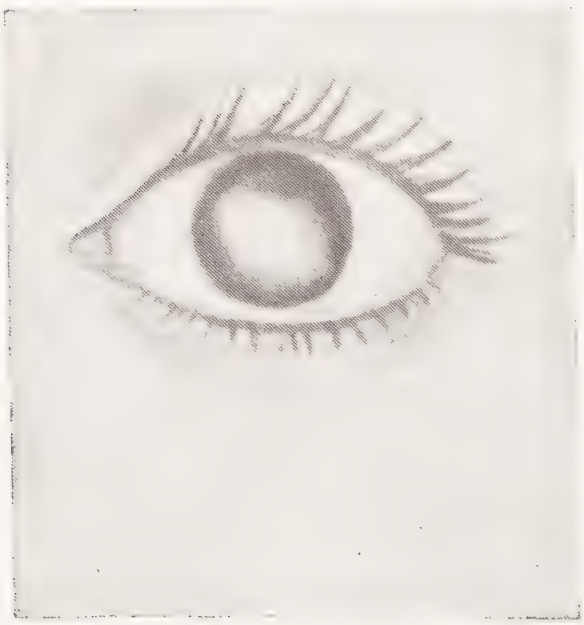
CASE NO. IV

BEFORE

AFTER KERATOPLASTY

CASE NO. V



KERATOPLASTY

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Before Operation

After Operation

Previous history.—History of injury in R. E., with a piece of glass 2 years back, followed by inflammatory attack.

Condition on admission.—R. E. Dense leucoma covering the whole of cornea. Pupil and anterior chamber were not seen. New blood-vessels were seen growing over the cornea. Tension—normal. Vision—P. of L. and projection good.

L. E., normal vision, 6/6.

Operation.—Kerato-plasty done on 14-9-36.

Donor—Hindu female, age 50 years. L. E. Absolute glaucoma. No. P. of L.

Stitches removed on 20-9-36. Cornea was kept well in position. Graft seemed to become opaque.

Discharged—Graft on 3-10-36 had taken nicely, but became opaque.

Vision—F. M. only.

CASE 4.—S. P. Mukherjee, Hindu male, 24 years, admitted on 29-9-36.

Complaint.—Loss of vision in R. E. duration 7 months.

Previous history.—Had an attack of Epidemic Dropsy glaucoma in R. E., for which R. E. was trephined 7 months ago, followed by intra-ocular hæmorrhage and dislocated lens.

Condition on admission.—R. E. Cornea opaque with brownish tint. Pupil and anterior chamber were not seen. Trephine bleb filtering well. Tension—normal.

Vision—Perception of light only.

L. E., normal.

SLIT-LAMP EXAMINATION.—R. E. Deep layers of the cornea were opaque. Pupil cannot be seen. The position of the lens could not be elicited definitely. It was supposed that lens had been dislocated in the anterior chamber and had been adherent to the inner surface of the cornea.

Treatment.—On 30-9-36, with a limbal incision anterior chamber was opened. No lens found in the anterior chamber which was washed.

Pupil. Normal.

Kerato-plasty was done on 16-10-37.

Donor—Hindu male, 22 years. L. E. Pseudo-glioma (exudative choroiditis) with clear cornea.

Stitches removed on 22-10-37. Graft kept well in position.

Pt. discharged on 29-10-37. Graft taken nicely, but became opaque.

Vision—F. M. only.

Case 5.—P. P. Nabish, Hindu male, aged 13 years, admitted on 8-8-35, with following complaints:—

(1) Occasional redness, watering and pain in both eyes, duration 8 months. (2) Gradual loss of vision in both eyes, duration 8 months.

Condition on admission.—B. E. Cornea densely opaque, excepting a clear portion round about the limbus. Anterior chamber were found to be deep, but the pupil was not seen. Vision—Finger movement only which was not improved even after putting mydriatics.

On Slit-Lamp Examination.—The opacity of the cornea was found to have extended deep to the interstices. Formation of new blood vessels was observed growing over the cornea. Pupils could not be seen.

Blood for W. R. was found to be negative. Other signs of congenital syphilis were present.

Treatment.—Had a full course of anti-syphilitic treatment. Locally, the eyes were put under atropine. When the eyes were quiet the opacity did not clear and the patient was discharged and advised to carry on treatment. As the opacity did not clear up the patient was re-admitted after a year and it was proposed to do Kerato-plasty. Operation was done on the left eye on 17-11-37,

Donor—A Hindu female, aged 70 years. L. E. Absolute glaucoma with clear cornea.

After-treatment.—Stitches removed after six days. Graft was kept in position and remained quite clear. Discharged on 15-1-37. Vision—6/60.

Tarsectomy in Trachoma*

BY

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In the later stages of trachoma, copper has so far maintained its supremacy and has stood the test of time as the principal remedy in the medical treatment of trachoma, but for the treatment of the complications and sequelae that follow, surgical intervention is the only effective method of obtaining almost a radical cure. These observations have been based on a series of over 150 cases operated by me during the last few years and observing the beneficial results following this method of operation. Realising that the upper fornix being the seat of trachoma could well be eradicated by its surgical removal, this method was advocated by Benedict in 1822 and this was later on modified and revised by Galezowsky in 1874. The attention of these early observers was not directed to attacking the thickened tarsus with the hypertrophied conjunctiva over it, till Heisrath supplemented the excision of the fornix with a partial excision of the tarsus. This was in later years further developed and modified by Kuhnt. Hence, this form of surgical treatment of trachoma has evolved from :—

(1) simple excision of the conjunctival fornix;

(2) excision of the fornix with a piece of the tarsal plate ;

(3) tarsectomy by total removal of the tarsus with the over-lying conjunctiva;

(4) tarsectomy by total removal of the tarsus with the over-lying conjunctiva and in which a mucous graft from the lip is incorporated.

It is the last two types of methods that are most effective in advanced cases of trachoma that are not amenable to medical treatment and in which the tarsus is greatly thickened and the conjunctiva hypertrophied with advancing pannus and recurrent corneal complications. It is also effective in treating very chronic and unresponding cases of palpebral type of vernal catarrh and irritating conditions like multiple calcareous deposits in the tarsal conjunctiva. The operation should not be attempted whilst the eye is in an irritable or inflammatory condition and

* Reprint from proceedings of All-India Ophthalmological Society.

with presence of corneal ulcers in an active stage; but it should be taken up after the eye is fairly quiet with the aid of medical treatment. It is also contra-indicated in cases where there are severe contractures of the fornix and conjunctiva resulting in symblepharon as a result of trachoma or irrational treatment of trachoma, unless a mucous graft from the lip is incorporated, as will be described later.

Technique of the operation:—

(1) Usual aseptic measures and anæsthesia of the eye with local instillations of 1 per cent. pantocain drops at frequent intervals. A subcutaneous injection with a solution of pantocain 1 : 1000 to which a few minims of adrenalin are added is given along the lid margin to prevent any pain whilst passing the sutures through the lid. The upper lid is then everted and a similar subconjunctival injection is given along the upper border of the tarsus so as to balloon out the upper fornix. (Fig. 1)

(2) The lid is kept everted and may be held in position with an Ehardt lid clamp. An inci-

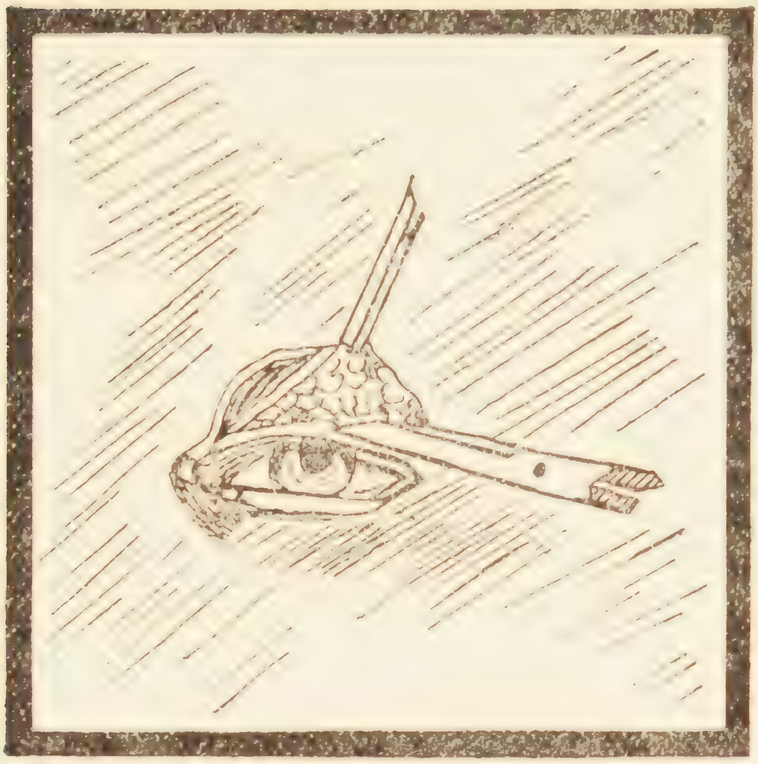
sion is made through the conjunctiva of the ballooned fornix from one end of the tarsus to the other and undermining of the conjunctiva is done towards the limbus.

(3) In the bulbar edge of the cut conjunctiva three loup sutures with double needles are placed equidistant from each other, one at either end and the third one midway between the two. About two to three millimetres only of the conjunctiva is grasped in the suture and its ends are placed aside. (Fig. 2)

(4) Supporting the everted lid on a lid plate, a deep incision about 1 millimetre from the lid margin is made in the tarsal groove from one end to the other so that this incision and the

former one done in the fornix meet at both the ends. (Fig. 3)

(5) The tarsus along with the conjunctiva over it is gently severed from the lid, taking care to produce the least mutilation or cutting of the levator muscle. This important step prevents any chances for occurrence of subsequent ptosis or troublesome bleeding. The tarsus with its conjunctiva is thus completely severed with scissors from all its attachments to the lid. (Fig. 4)



(6) The loup sutures with their free ends are passed through the lid about two millimetres from the lid margin and are brought out on the skin surface in the same order as before, equidistant from each other. The ends of these sutures are left well stretched, but they may be tied round a strip of gauze.

(7) As described before, in cases of severe contractures of the upper fornix, it is necessary to incorporate a mucous graft from the lip over the denuded lid surface. After local infiltration anæsthesia on the inner surface of a part of the lower lip of the patient, a mucous graft is removed corresponding to size slightly larger (about 2 m.m. all round) than the size of the tarsus that is removed (Fig. 5). The cut margins of the lip are easily brought into apposition by a single row of continuous sutures. The mucous membrane graft is made thin and supple by carefully denuding it from its submucous and fatty tissues with the help of thin scissors. It is then spread evenly with its raw surface in apposition to the denuded lid surface and there secured in position by two separate stitches passed at its either end, passing through corresponding outer and inner ends of the denuded lid surface. One of these sutures is then passed as a continuous row of stitches bringing into apposition the free upper

border of the graft with the cut bulbar border of the conjunctiva and the other suture is similarly passed joining the free lower border of the graft to the more superficial parts of the border of the cut lid (Fig. 6).

It is interesting to note that the mucous membrane from the lip does not become affected with trachoma or vernal catarrh.

Daily antiseptic dressing is done with bandaging. It is preferable to apply an emolient sterile ointment under the lid so as to prevent any corneal abrasion from the sutures. The stitches are removed on the fifth day and the patient is told to use mild preparation of silver for daily instillations and a pair of dark protective glasses till all redness had disappeared.

There are no unusual complications excepting the presence at times of some polypoid frills which are due to taking more of conjunctival tissue in the sutures that are passed through it; but these are very easily snipped off later on. No sequelæ, such as contractures or distortions of the lid or ptosis, follow the operation if it is carefully performed.

There are different variations in the technique of this operation, but the one described here is in my opinion the quickest and the easiest mode of approach without giving rise to any troublesome complication either during or after the operation, and which I have consistently with advantage followed during the last few years in all my cases. As all the cutting is done on the everted lid there is no subsequent disfigurement and no scar is visible on the skin of the lid thereby giving the best æsthetic effect especially in young patients by removing all traces of any operation having been performed on that eye. There is one method of approaching the tarsus externally by cutting the skin of the lid, but for the reasons afore-described and in the absence of any special advantages, it is disfavoured.

The end results of the operation are very good. The patient is relieved from the lacrimation, gritty sensation and photophobia. The mechanical ptosis disappears together with the tendency to entropion and trichiasis. There is an earlier improvement of the corneal complications and the pannus gets reduced with improvement in vision. Recurrences of acute exacerbations are very infrequent, and if at all they occur at long intervals, the attacks are usually not severe and respond promptly to the usual local treatment.

Surgical Treatment of High Myopia

BY

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The first ophthalmologist to accomplish extraction of the lens in myopia was the Abbe Desmonceaux of Paris, who performed this operation in 1776. It was revived sixty years later by Fukala, of Vienna. The younger patients (below 16) are operated on by repeated discissions or by discission followed by linear extraction. The older patients are operated by intracapsular extraction. Improvement in vision and increase in the distance at which eyes can be used for near work are the results of successful operations.

The chief indications are progressive myopia of over 14 diopters not improved by glasses.

According to Elschnig, only one eye should be operated on at a time and the second eye should not be operated on until the eye that had been first operated on has been perfectly quiet for at least six months. The reason for this delay is the possibility of detachment of the retina, which may occur in any myopic eye.

The operation is contraindicated if any gross macular lesion is present.

The chief complications are: Intraocular haemorrhage, detachment of the retina, secondary glaucoma and iritis.

To compute the probable correcting glass after removal of the lens, one should divide by 2 the number of diopters of the correcting glass of the complete eye, and when concave, subtract it from 11D, and when convex, add it to 11D, that is, if the original myopia is 18D the patient will take about +2D correction after the removal of the lens.

Tarsectomy through the External Incision as a Permanent Cure in Late Stages of Trachoma

BY

DR. C. N. SHROFF, D. O. M. S (LOND), BOMBAY

Subject of tarsectomy is one concerning which there has been much discussion, and a good deal of difference of opinion exists regarding the operation. A great many eminent authorities advocate it strongly, while equally good authorities condemn it.

From the experience of 250 cases of operations performed by me on the lids for the permanent cure of trachoma in its late stages by this method in the course of last twenty years, I can definitely say that this method gives excellent results if done in right kind of cases where medical treatment is not giving satisfactory results.

A comparison of Trachoma and Syphilis will prove most useful. In trachoma patient does not suffer greatly in the earlier periods of the disease, the same is true of syphilis in the primary and secondary stages, but after a year or so, sometimes not until after many years, trachoma produces far more serious changes in its late stages, and like syphilis, may entail serious complications and a method that gives, satisfactory results in those late stages, deserves our proper attention. The operation should not be attempted whilst the eye is in an irritable or inflammatory condition and with presence of corneal ulcers in an active stage.

In order to establish the exact place of this operation in the treatment of late stages of trachoma, the factors which are responsible for the beneficial results should be analysed and properly understood.

First:—The orbicularis muscle in trachoma is kept in a state of spastic hypertonicity through constant reflexes from the diseased conjunctiva. This is aggravated by the hypertonicity and engorgement of muscle and in later stages by a cicatricial contraction of the total structure. The increased lid tension thus produced, is the real factor for serious complications of trachoma.

On the other hand, the avascular cornea depends for its nutrition on the proper functioning of the lymphatic channels. Excessive pressure upon its lymphatic system results in the impaired state of nutrition and increases the possibility of ulcer or pannus formation. Under these conditions, this operation relieves the eye-ball from the abnormal pressure by removing a considerable amount of tissue between the orbicularis muscle and the globe. In addition, the operation when it is done through the external incision in the lid, results in severing many of the orbicularis muscle bundles which remove orbicularis spasm. In his interesting work on the importance and the measurements of the lid tension, Birch-Hirschfeld states, that with a specially constructed instrument, he found the lid pressure in cases of trachoma with corneal complications considerably higher than the normal eyes, and he justly attributes this factor an important place in the ætiology of pannus. The same view was seemingly held by the late Lewis Ziegler judging from the following sentence from his paper on the Surgery of Trachoma. "The corneal lesions will automatically disappear whenever the lid pressure is properly relieved. The operation described below reduces this lid pressure efficiently and permanently".

Secondly:—The tarsus is as much a seat of inflammatory infiltration in severe cases of trachoma as is the conjunctiva itself. Tarsus in recent cases is thickened owing to rich cellular infiltration of round cells and mast cells, which may penetrate, deeply into it, finding their way along the blood vessels, particularly the upper and lower arterial arches. Later on it shrinks, its glands disappearing, and nothing being left, but a tough connective tissue, but a very potent source of re-infection of cornea. This degeneration and softening leads to deformation--a primary affection of the tissue, rather than a mechanical deformation secondary to contractions of the mucous membrane, although this factor may enter into the question also in some cases. Thus it is natural that a considerable part of the cartilage must be removed in any operation done for the purpose of permanently curing the trachoma in its late stages.

The Third important factor in trachoma is the peculiar drooping of the lids, giving the patient a sleepy appearance, due partly to the weight of the swollen tissues partly to the myopathy of the Muller's muscle and the involvement of the levator extension in the scar tissue, so that the ptosis becomes more or less permanent. In this operation, by detaching the levator from the upper border of the tarsus and attaching to the lower border after

removal of the greater portion of the tarsus, the ptosis is permanently removed.

It is hard to see why any part of the conjunctiva should be removed. The extensive or inextensive sacrifices of the conjunctiva that were adopted for the treatment of trachoma forty or fifty years ago by Heisrath and with its modifications by Kuhnt were in accordance with the ideas of those years, that the trachomatus process were limited to the tarsal conjunctiva or to the fornix, and that the removal of those tissues might bring a cure of trachoma. As a result of numerous contributions to the pathology in the last two decades, we know that the trachomatous changes are found quiet early in the upper part of cornea, in the tarsus and in the levator muscle.

One cannot expect to cure trachoma by removing any part of the conjunctiva; exposed as the conjunctiva is, it can easily be subjected to the treatment by the ancient remedy of copper stick which has been used for thousands of years, is still the drug, which by its combined astringent and bactericidal effect and by its power to excite phagocytic activity is apparently of most value in those cases. In acute cases silver is used to control the inflammation and for the diminution of secretion. When the conjunctiva is cicatrized and contracted and the cartilage deformed, these chemical agents do not work well and for these cases a simple surgical method is suggested.

Indications:—Once the manner in which this operation influences the course of the disease is properly understood, the indications of this operation can be easily established. It is used in late stages of trachoma, where the tarsus is degenerated and incurved, and the conjunctiva is wholly or in large part cicatrical but on account of pressure of lids, the cornea is irritated and there is pannus and frequent ulcerations. It should also be done in those cases where other methods have failed or in those cases in whom no further medical attention can be secured. It is contra-indicated in early cases without corneal complications, and in those cases where there is evidence of any marked tendency to shrinking (threatening xerosis).

In children in whom trachoma is more easily cured, radical methods such as excision are contraindicated, and expression combined with subsequent medical treatment should be used.

Operation:—The eye is washed and tinch. iodine applied on the skin of the lid to be operated upon. The

conjunctiva is rendered anæsthetic by the cocaine solution and the whole of the lid is injected with 2% novocaine solution.

First Stage:—An incision is made along the entire length of the lid with a scalpel 2 m.m. above and parallel to the lid margin. The incision should be carried down through the muscle to the tarsus. The lid clamp is put to control the hæmorrhage. The edges of the incision are now undermined above and below and the fibres of the orbicularis in front of the cartilage are removed with scissors and forceps so that the tarsus is laid bare. The region where the bending is most marked should be promptly exposed.

Second Stage:—We make two incisions through the tarsal cartilage from end to end. First a horizontal incision is made in the lower part of the cartilage 2 m.m. from its lower border. Similarly, a horizontal incision is made in the upper part of the cartilage. The entire cartilage thus marked is now dissected away from the underlying conjunctiva without injuring it. After the removal the tarsal cartilage in two pieces its upper border and the lower border and the two parts are joined together by means of conjunctiva. On rare occasions this conjunctiva is absent as the conjunctiva and cartilage are so fused together that they could not be separated. The 2 m.m. of the lower border should always be preserved for the stability of the lid border and the cilia.

Third Stage:—The surgeon now passes the sutures thus: he introduces the needle above the wound through the skin and subjacent tissues and through the tarsal cartilage making it appear at the cut edge of this last, the needle is passed onwards through the lower segment in the cellular interval between the orbicularis and the tarsus and brought out on the skin surface behind the cilia. Three or four such sutures are usually sufficient. When they are tied, the lower segment bearing the lashes is rotated on its own transverse axis, and the lashes instead of pointing downwards point forwards. When we have not been able to preserve the conjunctiva between the upper and the lower border of the cartilage, it is quite essential that the two parts should be properly joined together, otherwise there is danger of sloughing of the lower border. In such cases the sutures are passed in a different way. After the needle is passed through the upper segment, it is passed downwards and backwards through the lower segment of the cartilage, and it comes out through the skin behind the

Tarsectomy Through External Incision

AFTER OPERATION

BEFORE OPERATION

cilia. Three or four such sutures are taken. When they are tied together the two parts are properly joined. The lid clamp is removed. The two ends of the wound which are not included in the lid clamp are sutured with one suture on either side.

We should bear in mind that the purpose of tarsectomy and the taking of the sutures in the particular way is to advance the levator muscle and attach it to the lower border, and to lift the lid away from the cornea and to slightly evert it. The pressure of the lid on the cornea is completely removed. Actually a latent space is created between the lid border and the cornea.

Excision must, however, be carried out by an experienced and skilled operator, if irreparable complications are to be avoided. This should be particularly insisted upon since much harm is done by excessive and uncalled for excision, and thereby the method is discredited.

The time required for bringing about a cure is extraordinarily r.duced lasting a few weeks including after treatment.

By this operation the pressure and the pernicious friction of the lid and cornea being removed, secondary complications are prevented or cured; entropion and ptosis are prevented or compensated; inflammatory sequelæ, exacerbations and re-infections are in most part avoided and on the whole we get about 80% permanent cure.

CASE NOTES

A young boy of thirteen years was treated at Ahmedabad for about two years for trachoma in his left eye. As he did not feel better he came to Bombay and started my treatment. The conjunctiva was more or less cicatrized, but there was pannus and the eye remained in an irritable condition. Though he was under treatment for about two months he did not feel completely relieved of his trouble. He was operated upon by this method of tarsectomy through skin incision. After the operation he had total relief and the pannus cleared off completely. Though two years have passed off since the operation was done, yet he is completely free from this trouble in the left eye. From the photo one can see the marked improvement after the operation.

Webster's Operation for Entropion of the Upper Lid

BY

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Webster's operation was first introduced by Alex. MacRae, and published in the *British Journal of Ophthalmology* in January 1898. Later on, it was modified by Webster, over 37 years ago. Prof. MacRae used to claim it as the best operation for Entropion, though it was not accepted and followed by other surgeons at that time. Col. Wright of Madras gave this operation a fair trial and ultimately came to the conclusion that this operation was really superior to other Entropion operations, and consequently, he introduced it as a routine treatment for entropion and trichiasis of the upper lid, in the Government Ophthalmic Hospital, Madras.

The advantages of this operation are:—

(1) That it seldom fails, and if it fails, it can be performed repeatedly, without the least harm to the lid. (2) That it can be done when some other entropion operations have already been done without success and have shortened the lid. (3) That the cosmetic results are simply charming. There is no scar on the lid, or any other mark of operation, and nobody can say if the operation has ever been done. It is specially an operation of choice in young unmarried girls, where a good cosmetic result is absolutely necessary. In short, it is really very superior to other old-fashioned entropion operations in many ways, and especially in India where entropion is so common in all the ages, this modern operation has its own charms for us.

Technique of Operation:—

It is necessary to see that the eye is clean and there is no discharge from the eye. The patient is instructed a day before the operation, to keep the teeth and mouth clean by frequent gargling and also advised not to chew betel-leaves. This will ensure a clean healthy mucous graft from the lip, and the danger of sepsis is also eliminated.

The face and eye-lids are cleaned and the conjunctival sac is thoroughly irrigated with warm saline lotion. The upper lid is anaesthetised with novocain solution 2% to which is added a few drops of adrenalin (1 in 1000). This will render the whole operation absolutely painless. 3 silk stitches (silk No. 4) are passed into the lid margin, one in the centre, and two other on the sides, by means of which the lid is fully everted on the Webster's Spatula. (Webster's spatula is locally manufactured at Madras and by Down Bros. Ltd. (London).

An incision is now made in the conjunctival surface of the lid parallel to the lid margin and about 3 to 4 mm, from it. This incision goes from end to end of the lid, and goes right through the tarsal plate. It is not advisable to go so deep as to button-hole the skin surface but no great harm is done if this accident happens. The important point is that the tarsal plate must be completely divided. At each extremity of the lid, the incision is curved a little forward towards the lid margin, so as to give better cosmetic results. At the inner extremity this forward curve should end just external to the punctum. The failure of the graft to take can be avoided at this stage by slightly undermining the edges of the incision very carefully. In order to have good cosmetic results, the lid incision must be given by a sharp narrow knife; a Graefe's cataract knife is quite suitable for this purpose. On completion of the incision, the wound is carefully inspected to see that no hair roots have been left in the proximal part of the lid. If any are seen they are carefully taken out.

A moist pad is now placed on the wound of the lid. Bleeding in some cases is free, but it stops in a few minutes.

Now the inner surface of the lower lip is cleaned by an assistant and held everted. A little sterilised gauze is packed between the lower teeth and the lip so as to avoid blood going into the mouth. By a sharp knife the surgeon marks a strip of mucous membrane, of somewhat more than the length of the lid incision and 4 or 5 mm. broad, and cuts this strip of mucous membrane. The wound in the lip is at once sutured by an assistant with a horse-hair suture.

The strip of the mucous membrane is now laid on the outer side of the thenar eminence of the operator's left hand, with raw surface exposed. From the raw surface the fat and submucous tissues are carefully removed with a

sharp, curved on flat small scissors until the strip is so thin, that it may be difficult to say which surface is which. We must be very careful not to button-hole the graft. The thinner the graft, the better apposition can be got with it, and the more certain it is to "take". When sufficiently thin its sides are trimmed parallel and the ends pointed. Now this graft is ready for use, and it should be put in a bowl of warm saline lotion till required.

The pad is now removed from the wound. The line of the incision will be found filled with blood-clot. This is very gently removed by forceps or by swabs so as not, if possible, to re-start the hæmorrhage. The graft is now removed from the saline lotion and then placed in position; convenient instruments for this purpose being a pair of fine-pointed, light dissecting forceps and an iris repositor. If the graft is found a bit longer it is shortened. It is very important to see that the graft should lie in, and covering the groove made by the incision, the pointed ends lying in the two curved ends of the groove, care being taken that it is pressed well down on the lid and well under the over-hanging edges of the cartilage above and below, and its edges are not curled in. It does no great harm if the sides of the graft over-lap the sides of the groove, but the points must lie in the groove, as otherwise they are apt to get out of position on closing the eye. The lid which was everted is now very carefully and gently replaced, and the stitches from the lid are removed, care being taken not to disturb the flap. The lower lid should be brought in apposition to the upper lid otherwise the lower lid may disturb the flap if it gets under the upper lid. If one is very particular to see if the flap is in position, then he can cautiously raise the lid margin with the finger and examine the conjunctival surface. If the graft is displaced in the act of replacing the lid, then it can be smoothed into position by an iris-repositor without again everting the lid. Both the eyes are bandaged and the patient is asked to lie quietly in bed for 24 hours. He is given milk diet during this period. The bandage is opened on the 3rd day, and the other eye is released. Later on, the operated eye is bandaged daily after dressing for 10 days or so. This dressing should be done very gently and lightly, not disturbing the graft by any means, and the lid should not be everted for a week, as this may displace the graft. After the 9th or 10th day, a weak caustic may be applied to the everted lid if the graft seems to be slightly raised anywhere. The stitches from the lip are removed on the 7th day, tincture-iodine being touched daily.

During our practice, we have come across only about half-a-dozen cases who returned back to the Hospital with hypertrophied mucous grafts, just hanging on the cornea. This complication was mostly due to faulty management of the mucous graft. These were excised, and touched with strong caustics and later on with copper, and were completely cured within a week's time.

We have consistently with advantage followed this operation in all our cases of entropion of the upper lid. The steadiness of the therapeutic results obtained, easiness of performance, and the beautiful cosmetic results, all these data, in my opinion, are sufficient to recommend to oculist the application of this operation in all cases of entropion of the upper lid. It is always preferable if the patient continues anti-trachoma treatment for some time so that no attacks of sore eyes may come in future.

Short Notes on Iridectomy, Trephining, Excision of the Tear Sac, Excision of the Eye-ball

IRIDECTOMY

Indications:—(i) Acute congestive Glaucoma (2) Opacities of the cornea. (3) Iris prolapse (4) Ring Synechia (5) As a 1st step in Cataract extraction (6) Staphyloma cornea.

Iridectomy with a cataract knife:—

Anæsthesia of the eye:—Local anæsthesia with or without Facial nerve block or Facial akinesia.

Steps of the operation:—The eye is thoroughly douched with saline or boric lotion and the speculum is inserted. The patient is asked to look towards his feet. With a fixation forceps the eye-ball is pulled downwards. The surgeon, with the tip of the Cataract knife, pierces the sclera just 2 m.m. lateral to the temporal side of the limbus at the junction of upper $\frac{1}{5}$th with the lower $\frac{4}{5}$ths of the cornea and thrusts the blade of the knife horizontally parallel to the plane of the iris allowing to pierce the other side of the sclera just 3 m.m. medial to the nasal side of the limbus. The upward section is completed with gradual sawing movements. The upward section includes a part of the conjunctiva and sclera. With an iris forceps a small portion of the iris is taken out and cut with an iris scissors. The rest of the iris is reposited with an iris repositor. The conjunctival flap is also turned to its normal position by the same instrument. The eye speculum is removed and after putting Atropine 1% the eye is bandaged.

Accidents:—The lens capsule may be punctured. This may be avoided if the knife is passed horizontally parallel to the plane of the iris.

Hæmorrhage into the anterior chamber may occur as soon as the section is completed.

After Treatment:—Daily atropine is dropped for 7 days. After the 7th day the bandage is left off.

Iridectomy with a Keratome:—The procedure is the same as that with a Cataract knife except the section is made with a bent keratome.

SCLERO-CORNEAL TREPHINING

Indications:—Chronic simple Glaucoma, Staphyloma cornea etc.

Anæsthesia:—Surface anaesthesia with cocaine or Pantocaine and facial nerve block.

Steps of the operation:—The upper quadrant is chosen. About $\frac{3}{4}$" incision is made in the conjunctiva either straight or parallel to the equator of the globe, the ends of the incision extends a good deal away from the limbus. The flap is carefully dissected down to the limbus. The sclera near the limbus is exposed so as to expose the bluish edge of the cornea. About $\frac{1}{2}$ m.m. or less of the cornea is split. At this place the trephine blade is placed and trephined. As soon as the trephine blade goes into the anterior chamber the patient feels a sharp pain. The pupil is displaced upwards towards the wound with escape of aqueous humour through the hole. When the trephine is taken out, the iris baloons out through the hole pushing aside the disk at its hinge. The disk and a tiny portion of the iris is cut off gently by a scissor. The conjunctival flap is replaced. The site of the trephine hole is gently massaged to replace the iris to its position. Atropine is dropped and the eye is bandaged.

After Treatment:—Atropine is dropped daily for 7 days and the bandage is let off after the 7th day.

Complications and Sequelæ of Sclero-Corneal Trephining

(1) Slipping of the disk into the anterior chamber. (2) Permanent hypotony. (3) Loss of vitreous. (4) Closure of the fistulous orifice by scar tissue. (5) Development of Cataract. (6) Deterioration of vision. (7) Late infections. (8) Intra-ocular haemorrhage.

Development of Cataract:—

1. This is the most common complication. The cataract should be removed after it becomes ripe for operation.

2. Closure of the Fistulous orifice by scar tissue. This is specially seen in fatty, or diabetic patients. Constitutional treatment is advocated in addition to surgical interventions.

Deterioration and contraction of field of vision

This is due to damage of the optic nerve. There is very little treatment. Injections of strychinine may be of some help.

3. *Late Infections*:—These are less common. Sulphanilamide plays an important part in these cases in addition to the routine treatment of Milk injections, Atropine, Dionine, etc. The rest of the complications are generally averted in the hands of competent ophthalmologists.

EXCISION OF THE TEAR SAC

Indications:—Chronic inflammation of the tear sac with obstruction of the naso-lacrymal duct.

Anæsthesia:—The area in and around the sac is infiltrated with 2% Novacain and Adrenaline.

Steps of the Operation:—The lid is stretched by an assistant by placing the finger on the outer canthus so as to put the internal palpebral ligament into prominence. Then with a scalapel the surgeon makes a curved incision commencing above the stretched ligament and passes downwards and outwards for a short distance along the inferior margin of the orbit lying 3 m.m. internal to the inner canthus. The internal palpebral ligament is opened, then the fascia of the sac so as to expose the sac proper. The incision should be deeper above and shallower below. Muller's retractor is then inserted and the screws tightened. With the help of a blunt scissors the sac is separated from all its sides. Then it is pulled up so as to drag as much nasal duct as possible and is cut. After complete removal of the sac, the area is again inspected for any pieces of mucous membrane still remaining and if present, they are removed. With a sharp spoon the whole area is scraped out and cauterized with a carbolic acid swab. The Muller's retractor is taken out and the wound is closed by interrupted or continuous sutures of silk. Sutures are removed on the 7th day.

Difficulties in the operation:—

1. Correct location of the lacrymal sac. This can be easily be located by closely following the crest of the lacrymal bone. The bluish edge of the sac is also diagnostic.

2. *Hæmorrhage*:—This is very troublesome if the angular vein or its branches are injured. This can be avoided if the incision is made 3 to 4 m.m. internal to the medial canthus. For small haemorrhages Adreneline or Hydrogen Peroxide will suffice. If the haemorrhage is persistent the speculum is removed and the wound is packed tightly with gauze and cotton.

After Treatment :—The bandage is opened on the 3rd or 4th day and seen. The wound is dressed daily with aseptic dressings. Sutures are removed on the 7th day.

Zinc, Boric drops are advised for a week or two later.

EXCISION OF THE EYE-BALL

Indications :—(1) Injury of the eye-ball with complete loss of sight.

(2) Absolute glaucoma. (3) Panophthalmitis.

(4) Intra ocular tumours. (5) Staphyloma cornea with complete loss of sight.

Anæsthesia :—General anæsthesia is preferable. The operation can also be done under local anæsthesia.

Steps of the Operation :—After the introduction of the speculum, the conjunctiva is separated from the cornea all round with a straight scissors. With the back of the handle, the conjunctiva is separated from the sclera behind. The conjunctiva is reflected as far back to the insertion of the Recti muscles as possible. The tendons of the Recti-muscles are cut one after another.

The speculum is depressed a little to allow the eye-ball to come forwards with stretching of the optic nerve. The assistant now pulls the eye-ball forwards by his fingers. Then with an enucleation scissors the optic nerve is cut as far behind as possible. All the oblique muscles and other tissues connected with the eye-ball are cut and the eye-ball is taken out from the orbit. The conjunctiva is closed by interrupted or continuous sutures of silk. The eye is bandaged.

After Treatment :—The wound is dressed daily for a week and the sutures are removed on the 7th day.

Difficulties in the Operation :—

Hæmorrhage :—This may occur after the eye-ball is removed. This can be prevented by tight packing and bandaging. If necessary, the vessel may be sutured.

Importance of Systematic Examination in Ophthalmic Practice *

BY

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The practitioner who wishes to include Ophthalmology in the scope of his practice should get into the habit of systematic routine examination of cases if he is anxious to avoid pitfalls in diagnosis. He should draw up for his guidance an exhaustive scheme of examination and should master the details of such a scheme by constant application in practice. Once the details are so mastered, he will be able to vary the scheme according to the needs of individual cases. A careful record of the findings should be kept. Rough sketches should if possible be made as they add very much to the value of the record.

Ophthalmic patients may be roughly divided into two groups:—

(1) Those with manifest objective signs of disease, and

(2) Those with only subjective symptoms.

In the first group, the manifest external signs may suffice to account for the patient's symptoms. In spite of this, it is necessary to make a thorough functional and internal examination in order to exclude all other evidences of abnormality. This functional and internal examination may not be possible at the patient's first visit but it must not be omitted on that score. It must be done on a future occasion.

In the second group, where there are no manifest objective signs, after a rapid external examination, one can usually proceed at once to the functional and internal examination. [The best plant in these cases is to test central vision for distance and near, test field of vision by the confrontation method, test pupil reactions, examine tension, test roughly the condition of the extrinsic muscles and then proceed to ophthalmoscopic examination including retinoscopy. More elaborate examination of central and peripheral vision may be done later if it is found necessary as a result of the preliminary examination outlined above.]

* Reprint from " The Antiseptic ".

The scheme of examination should be elaborate but at the same time elastic. It can be conveniently split up into the following six divisions:—

I. Taking of History.

II. General Examination of the patient.

III. External Examination of the Eye.

IV. Testing of motility and Muscle Balance.

V. Functional Examination of Eye.

VI. Internal Examination of Eye.

Let us now consider the salient points to be investigated under each of these heads.

TAKING OF HISTORY

1. *History of present eye disease*:—Ask the patient what he complains of about his eyes:—*e.g.*, Watering of the eyes, discharge from the eyes, pain, grittiness of the lids, photophobia, blurred vision, double or multiple vision, flashes of light before eyes, spots before eyes, etc.

Find out by questioning, how long he has been suffering from the complaint or complaints and whether there is any seasonal variation in the severity of the complaint. Do the lids stick, especially overnight? What is the character of the pain? How severe is it? Where is it felt chiefly? Does he suffer from headaches? If so, where is it felt most? Is the headache present all the time or is it worse in the evenings after use of the eyes during the day? Is there any vertigo? Has he had any recent injury to the eye or does he remember of any foreign body or insect having got into the eye? Has the patient been taking any medicine containing Belladonna? Has he used any medicine in the eye?

2. *History of past eye disease*:—Has the patient suffered from similar or different eye disease previously? If so, let him give brief particulars.

3. *History of any present or recent systemic disease*:—Does he suffer from any venereal disease or disease of the kidneys? Does he suffer from diabetes? Has he recently suffered from measles, influenza, etc.?

4. *History of any past illness*:—Has he had any head injury? Has he suffered from venereal or any systemic disease, etc.?

5. *Family History*:—This will give an indication as to whether the patient has any hereditary tendency to eye disease.

6. *Age and occupation.*

GENERAL EXAMINATION OF PATIENT

1. Note general appearance of patient and position in which he holds his head.

2. Examine face and note if there is any facial asymmetry, facial paralysis, affections of skin like herpes, ophthalmic acne rosacea, etc. Examine for stigmata of congenital syphilis.

3. Examine the accessory nasal sinuses.

4. Examine the teeth for evidences of congenital syphilis and rickets.

5. Examine the other systems, particularly the Nervous, Circulatory and Urinary systems. Examine for focal infections. Blood for W. R. if required.

This last under 5, may be deferred till later on in the examination.

EXTERNAL EXAMINATION OF EYE

Proceed in a systematic way from the superficial to the deeper parts. It is hardly necessary to mention that both eyes should be examined.

1. First examine the *lids*, and note their position, mobility, the width of the inter-palpebral fissure, whether there is ectropion or entropion, whether the skin covering the lids is excoriate and whether there are any chalazia. [Presence of small chalazia can often be detected more easily by gently running the fingers over closed lids] Note whether the lids close properly.

Examine the Lid Margins and note their form and outline. See whether the cilia are correctly placed. Note presence or absence of blepharitis and of styes. Note whether the Puncta Larimali are normally placed and patent. [Sometimes an eyelash may be blocking the lower punctum and may be causing epiphora.]

2. Examine the Lacrimal Sac for evidence of inflammation. Press over the sac and note if contents regurgitate through puncta. [Remember that the major portion of the sac lies below the level of the internal palpebral ligament.]

3. Examine the Preauricular Lymph Gland. This gland is normally not palpable.

4. Examine the eye-ball and note its size, shape, situation in orbit and direction.

5. Next, examine the *conjunctiva*. Pull the lower lids down and ask patient to look up. In this way the conjunctiva of the lower lid and lower fornix is brought into view. Look for injection, follicles, papillas, scars, concretions, foreign bodies etc. Remember that a favourite site for minute foreign bodies is about 2 m.m. from the lid margin at about the middle of the lid on the palpebral conjunctiva. Look for evidences of subjacent chalazia.

Examine the ocular conjunctiva for injection, altered secretion, phlyctenules, chemosis, hæmorrhages, growths, degenerative changes, wounds, foreign bodies, etc. Embedded foreign bodies may be indicated by patches of soft granulation tissue over their sites.

If injection is present, note whether it is conjunctival, whether it is chiefly posterior or anterior conjunctival. Remember that anterior conjunctival injection occurs chiefly in inflammations of the limbus and of the superficial layers of the cornea and that ciliary injection in its pure form occurs in deep inflammations of the cornea, inflammations of iris and ciliary body, and in glaucoma. [Remember that ciliary injection is distinguished from conjunctival injection by the fact that the latter consists of separate vessels which are clearly visible as bright red tortuous lines which branch in an arborescent fashion and which can be moved with the conjunctiva whereas in ciliary injection the individual vessels cannot be clearly distinguished, their colour is a purple red and that the vessels cannot be moved with the conjunctiva.]

Next, evert the upper lid and examine the conjunctiva of the upper lid and fornix. [The simplest way to evert upper lid is to make the patient look down, place a match stick or thin glass rod on the outside of the lid above the tarsus and keeping a gentle pull on the lashes, turn the lid over.] The points to be noted are the same as in the lower lid.

Perpare a smear of discharge for microscopical examination for organisms, nature of cells, etc.

6. The chief points to look for in the *sclerotic* are changes in curvature and colour, ciliary injection and evidences of episcleritis and scleritis.

7. Next, in the order of examination, comes the *Cornea.* Remember that the normal cornea is regularly curved with an even and polished surface, is perfectly transparent, is free from any vessels and is extremely sensitive. Keeping these points in mind, after noting the size of the cornea and its curvature, examine its surface carefully for any abrasions, ulcers, foreign bodies, vessels, etc. The best way to examine the corneal surface is by making the patient follow with his eye the examiner's finger in different directions and by noting the character of the window reflex on the cornea. This in healthy cornea is regular and clear cut. As further aids to diagnosis, the use of oblique illumination and instillation of 2 per cent fluorescein may be used. Oblique illumination consists in focussing either day light or artificial light on the cornea by means of a strong convex lens and examining the spot so illuminated with the naked eye or better still through a corneal loupe. Areas on the cornea which are denuded of epithelium are stained green by fluorescein. Remember that a leash of vessels near the limbus may mark the site of a foreign body or a minute abrasion on the cornea.

Next, examine the substance of the cornea for opacities, foreign bodies, vessels, etc. Here again oblique illumination and examination through the loupe will be found of great help.

When vessels are seen in the cornea determine whether they are superficial or deep [by keeping in mind the following points of distinction between them. Superficial vessels can be traced over the limbus into the conjunctiva, are bright red and well defined; branch in an arborescent fashion dichotomously and may raise the epithelium over them making the corneal surface uneven. Deep vessels cannot be traced beyond the limbus, are ill defined and dull red, run more or less parallel to each other and branch at very acute angles and do not affect the evenness of the corneal surface.].

Test the sensitivity of the cornea by touching it with a wisp of cotton wool twisted to a fine point.

Examine the posterior surface of the cornea by oblique illumination and loupe for any K. P. (Keratic precipitates).

8. *Anterior Chamber*:—Note its depth. Remember that it is shallow in old age, glaucoma, dislocation of lens,

hypermetropia, etc., and deep in buphthalmia, iridocyclitis posterior dislocation of lens, myopia, etc.

Examine its contents. The normal aqueous is perfectly clear and transparent. Abnormalities to look for are hypopyon-hyphaemia, foreign bodies, dislocated lens, etc.

9. The *Iris* should be examined next. Examine its colour, pattern, and position. Look for adhesions, nodules (gummata and tubercles) and growths. Note whether it is tremulous. Look for holes especially at the periphery (Iridodialysis). The colour may be altered as a result of atrophy or due to the condition known as heterochromia. In this there is a difference in colour between the two irides or between parts of the same iris. It may be congenital or due two iridocyclitis. The pattern is obliterated in iritis. Tremulousness of iris (Iridodonesis) indicates shrinkage, dislocation or absence of lens.

10. *Pupil*:—Note shape and size, whether it is equal on both sides, whether it is centrally placed and whether it is quite black. Look for synechiae. Test direct and consensual reactions to light and reaction to convergence. Note whether the reaction to light is sustained.

11. Only the anterior layers of the *Lens* can be satisfactorily examined at this stage by means of oblique illumination and loupe.

12. Examine the Intra Ocular *Tension*.

MOTILITY AND MUSCLE BALANCE

Test the range of movements of the eye. If any motor anomaly is present determine its character, extent and cause by an examination conducted according to a systematic plan.

FUNCTIONAL EXAMINATION OF EYE

This consists in testing the light sense, form sense, and colour sense.

Testing of light sense is difficult and may be omitted.

Form sense is examined by testing the Central and Peripheral vision.

Central Vision:—In testing this, proceed according to a systematic plan. Analyse the patient's glasses if he is wearing any. Find out how long he has been using them and how often he has had them changed.

Take distant vision of each eye separately and also that of both eyes together. Use good charts at six metres. [If vision is less than 6/60, find out at what distance the topmost letter can be seen. *e. g.*, V. R. 3/60. *i. e.*, patient can read with right eye the largest type at 3 metres. If largest type cannot be distinguished at all test with fingers and note at what distance they can be counted. *e. g.*, c. f., at 1 metre. Failing this, see if hand movements can be made out. Failing this also, note if there is P. L. *i. e.*, perception of light. If no P. L. the eye is completely blind.]

Although 6/6 is taken as normal, most healthy young persons can see better than this, even down to 6/3.

Test manifest hypermetropia, *i.e.*, find out the strongest convex spherical lens which the patient accepts.

Test near vision with Jaeger's or Snellen's types. Note what is the smallest sized print that he can read and also what is the least distance at which it can be read, *e. g.*, J. 2 at 25 c. m.

Determine the range of accommodation, *i. e.*, difference between refractive power of eye when accommodation is exerted to its utmost and when it is at rest.

If there are no facilities for retinoscopy and if the case is obviously one of refractive error, subjective test of refraction may be done at this stage. But it is important that a systematic plan is adopted. Otherwise subjective refraction test is sure to prove very tedious and difficult.

If a cycloplegic has been used for investigation of refraction and if an error has been revealed, perform a post cycloplegic test with lenses at a future date if necessary.

Peripheral vision is tested in order to determine the state of the perceptive elements of the retina other than the macula which is of course responsible for central vision. The peripheral vision is tested by mapping out the visual field by any of the recognised methods. A rough but fairly useful method is the confrontation test. In this the Surgeon's hand or a square of paper held in a pen-holder is used as the test object. In cases where the hand cannot be seen as in mature cataract, a lighted candle or the lamp of the electric ophthalmoscope is used as the test object.

A more accurate determination of the visual field is done if necessary with the perimeter and tangent screen.

A rapid test of colour vision can be made by means of Ishihara's charts, other methods are more elaborate and complicated.

INTERNAL EXAMINATION OF THE EYE

For satisfactory examination of the deeper parts of the eye, a dark room, a good lamp and a really good ophthalmoscope—preferably an electric one—are necessary. It is also necessary in most cases to dilate the pupils. [A good way of getting rapid and satisfactory dilatation of the pupils is to instil one or two drops of a 2 per cent solution of Homatropine and cocaine, and keep the patient in a darkened room for about half to one hour with the eyes bandaged.] If it is intended to perform retinoscopy, and if the patient is young it is advisable to paralyse the accommodation thoroughly by the use of cycloplegics. In the very young, the only sure way of attaining this object is by the use of 1 per cent Atropine drops or ointment three times daily for at least 3 days.

Internal examination of the eye should also be conducted in a systematic manner. The following routine should be followed :—

1. Examination with the ophthalmoscopy by the *Distant Direct method*. In this the examiner holds the ophthalmoscope at a distance of about 25 c.m. from the eye of the patient and reflects light into the eye. By noting the character of the fundus reflex he can ascertain whether there is any gross error of refraction and whether the media are clear. He can often detect the presence of detachment of the retina. If opacities are present he should note whether they are fixed or floating. He can determine the location of fixed opacities by the parallactic method, *i.e.*, by noting their displacement in relation to the pupillary plane when the eye is moved.

2. Examination with the ophthalmoscope by the *Indirect method*. [This is like examination with the low power of the microscope.]

3. Examination with the ophthalmoscope by the *Direct method* [This is like examination with the high power of the miscroscope.] Start with a plus 20 or stronger lens behind the hole of the ophthalmoscope and gradually reduce the strength of the lens and if necessary bring in concave lenses of gradually increasing strength. In this way successive parts of the eye from the cornea down to the fundus can be examined.

4. *Retinoscopy* :—Internal examination with the ophthalmoscope, besides confirming some of the findings already elicited as a result of the external examination, enables one to investigate the following parts of the eye which could not be examined before :—(1) Deeper parts of the Lens. (2) Vitreous. Look for changes in consistency, opacities, foreign bodies, hæmorrhages, exudates, persistent hyaloid artery, etc. (3) Fundus. The best order to follow in the examination of the fundus is optic disc, retinal vessels, macula, and finally the rest of the fundus. Examine the whole of the fundus systematically and thoroughly.

N. B.—If a mydriatic has been used to dilate the pupil of an elderly patient for the purposes of thorough investigation do not forget to see that the pupil is contracted by means of Eserine before the patient leaves the consulting room.

THE END